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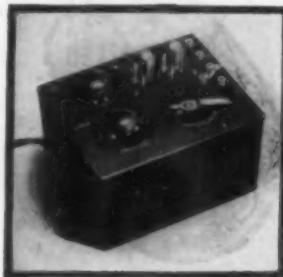
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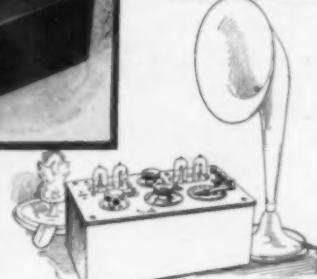
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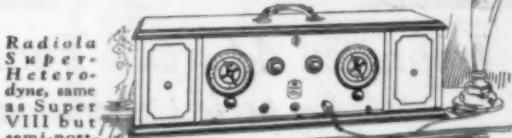
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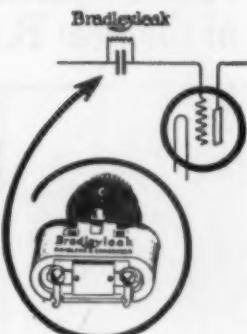
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The Official Organ of the A.R.R.L.

VOLUME VII

MARCH, 1924

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THE AMERICAN RADIO RELAY LEAGUE, Inc.
HARTFORD, CONN.

THE AMERICAN RADIO RELAY LEAGUE

The American Radio Relay League, Inc., is a national non-commercial association of radio amateurs, bonded for the more effective relaying of friendly messages between their stations, for legislative protection, for orderly operating, and for the practical improvement of short-wave two-way radio telegraphic communication.

It is an incorporated association without capital stock, chartered under the laws of Connecticut. Its affairs are governed by a board of seventeen Directors, elected every two years by the general membership. The officers, in turn, are elected by the Directors from their number. The League is non-commercial and no one commercially engaged in the manufacture, sale or rental of radio apparatus is eligible to membership on its Board.

"Of, by and for the amateur," it numbers within its ranks practically every worth-while amateur in America and has a history of glorious achievement as the standard bearer in amateur affairs.

Inquiries regarding membership are solicited. Ownership of a transmitting station, while very desirable, is not a prerequisite to membership; a bona-fide interest in amateur radio is the only essential. Correspondence should be addressed to the Secretary.

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EDITORIALS

de AMERICAN RADIO RELAY LEAGUE



Our "Business"

WHAT'S happened to relay traffic? Here it is the height of the season, when things should be their busiest, and yet our volume of traffic handled is small. To be sure there are lots of messages moving, but their number is small in comparison with what it used to be. One can listen all night and hear only a few real cases of traffic handling, one can try all night to find some business and get only QRU's—it's a devilish hard job to find a dozen messages a night that need relaying.

As an organization we fellows never have become quite accustomed to the idea of mere rag-chewing. We've acted very much as if an actual excuse were necessary to work another station, and that "excuse" has been message-handling. Consequently the nights this winter are filled with fleeting and unsatisfactory contacts of just enough duration to find out that neither of us has any message traffic, and then we drop each other like hot potatoes. We are essentially an organization of doers, and we have nothing to do. And so we are running around in circles, calling our heads off, making the night hideous with fruitless CQ's, on our toes and looking for things to do but finding nothing, and always the air reverberates with the mocking answer "QRU". We have our tests and our stunts, it is true, and we enjoy them heartily and make a good showing every time such an occasion rolls around, but we can not exist on them—they provide us nothing in between the red-letter dates.

There may be danger in such a situation. Our organization has succeeded where all other attempts failed because, primarily, we had a method of keeping in close contact with one another. Message traffic required a network of good stations, and the network bound us together. Without the traffic will we hang together?

Perhaps we're a little down in the mouth on the subject—it snowed again today and we thought spring had come. Let's look at the other side of the picture: An elaborate traffic scheme was necessary in order to provide a place for every station, back in the days when we all used sparks. The range of a station in those days was more or less in proportion to its power. We had to have a system that would give interesting activity to the low-powered station. Today, with C.W., all that is changed, and

the "5-watter" gets as many cards from the opposite coast as the big fellow with the two 250's. Power doesn't cut much ice any more. The 5-watter gets in all the tests and often as not grabs the bacon from his big brothers and goes home with it. Perhaps the day is waning when a big traffic system is a really necessary thing to bind us all together.

We heard one well-known amateur thank heaven the other day that the business of seeking mere volume in traffic handling was over, for now the air is less cluttered and there is a chance to get a really important message relayed. He regarded the period of voluminous message-handling as the "kid days" of American amateur radio, and was rejoicing in the knowledge that today it is increasingly more possible to get on the air and converse with a radio friend or to do more useful work. Isn't that about right? Shouldn't we really be thankful that we are outgrowing the day when our sole thought is to get a bigger message-total than the other fellow? Isn't our present hectic ether attributable to the fact that we are just growing away from a system in which we were all automatons and into a new era in which we have not yet fully found ourselves as humans? Let's develop the *human* side of amateur radio a lot more in our work on the air—the possibilities are enormous.

Now, what are your thoughts about this big question? Do we need a "business"? We'd like your help in this, fellows. What do you think about it? Don't let George answer for you, but take your pen in hand and write your thoughts to A.R.R.L. Headquarters.

The Short Waves

IT is regrettable that the present radio regulations do not provide some really short waves for the amateur. We need some short waves for our special contact problems, and because of their demonstrated usefulness we think every amateur should be entitled to their use. We feel, too, that we amateurs are better fitted to develop them practically than any other radio group—yet at present these short waves are so carefully "reserved" for "development" that almost nothing is being done with them.

Consider 200 meters for a moment, and hark back to that day but twelve years ago when wavelengths below 200 meters were

assigned to the amateur more or less to keep him out of mischief: useless waves so short that nobody could ever do anything with them. Reflect then on our progress, our steady development of methods and apparatus unique to the amateur world, our growing successes, until today we in America have dumped our signals into every continent on the globe! And consider the trans-oceanic communication work of the past few months, where on wavelengths in the vicinity of 100 meters good communication has been established with Europe using apparatus and methods exclusively of amateur origin. Are we not the folks to develop those waves?

We do not ask for their exclusive use, as obtains with the waves within our present band of 150 to 200 meters. We'd be content with them non-exclusively. At present the waves below 150 meters are used, apart from government use, only under experimental licenses. The Department of Commerce is increasing the restrictions on "X" licenses and the indications are that soon it will be almost prohibitively difficult for an amateur to obtain one. Only the few stations now in possession of X licenses are authorized to work on the short waves today, and unless some other regulations are arranged for we will soon be out of it.

What a pity that would be! Those waves do need developing, and we're the crowd to do it. Wouldn't it be fascinating to have an amateur band from 40 to 50 meters or even from 4 to 5 meters, where we'd have to develop totally new methods and brand-new apparatus to make them work? Real pioneering development, contributing something new to the art! And 70 to 90 meters or 110 to 125 meters, some band where our present knowledge will apply but still "short" waves as we know them today!

The big commercial companies are hard after these waves, fellows. Amateur work demonstrated their value, and that's why

there is a reservation today below 150 meters, with only three-months X licenses operating below the fence. The Westinghouse Co. is building a chain of 100-meter stations to convey broadcast programs around the country for rebroadcasting; that's what KDKA's 100-meter set is for. The Radiocorp. is experimenting with 100 meters to see if commercial traffic can't be handled there satisfactorily. The A.T.&T. is developing special short-wave apparatus for small marine craft, harbor tugs and houseboats and such like. Somebody obviously expects to get the use of some of those waves under the present amateur band.

This is just to say that A.R.R.L. Headquarters believes that we amateurs ought to have some of them too, and to ask you to think it over. There is new radio legislation in prospect, and the opportunity will come soon. When we go down to Washington we will want you to give us backing if you want those short waves!

Multa Gratitudi

A VERY pleasant and helpful custom has crept into the business of renewing one's membership in A.R.R.L., all unsolicited on the part of Headquarters and quite spontaneous on the part of the individual. Many of our members in sending in their renewal send along the name of a friend who should be a member. This is as much the rule as the exception today.

It is helpful to A.R.R.L. because we follow these up, write the friend immediately and tell him about the League, and because he is good material to start with we almost always get him in with the rest of us.

A great many thanks, fellows, for your bully good spirit in helping thus. It's the spirit of A.R.R.L.

And the others of you who have not done so yet—wouldn't you like to do this for your League too? It helps a lot.

ELECTION NOTICES

To All A.R.R.L. Members Residing in the Central, New England, Northwestern (including Alaska), Roanoke, Rocky Mountain, and West Gulf Divisions:

1. You are hereby notified that an election for a new A.R.R.L. Director, for a term of one year, is about to be held in each of the above Divisions, in accordance with the new A.R.R.L. Constitution and By-Laws, which were published in the membership edition of February, 1924, QST for your information. Your attention is in-

vited to Sec. 1 of Article IV of the Constitution, providing for the government of A.R.R.L. affairs by a Board of Directors; Sec. 2 of Article IV, defining their eligibility; By-Laws 12, 13, 14 and 15, providing for their nomination and election; and particularly By-Law 27, which especially for this election stipulates dates differing from those specified in the other By-Laws cited.

2. The election will take place during the month of April, on ballots which will be mailed from Headquarters in the first week of April. The ballots for each Division will list the names of all eligible candidates nominated for the position by

A.R.R.L. members residing in that Division. There will be one Director elected from each Division.

3. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members living in any Division have the privilege of nominating any member of the League in their Division as a candidate for Director. The following form for nomination is suggested:

(Place and date)

*Executive Committee,
A.R.R.L. Headquarters,
Hartford, Conn.*

Gentlemen:

We, the undersigned members of the A.R.R.L. residing in the _____ Division, hereby nominate _____ of _____ as a candidate for Director from this Division, for the election of April, 1924.

(Signatures)

The signers must be League members in good standing. The nominee must be a League member in good standing, and must be without commercial radio connections. His complete name and address should be given. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the first day of April, 1924. There is no limit on the number of petitions that may be filed.

4. Under the former constitution of the League, Directors did not represent specific territories. However, those now occupying the office of Director from the above-named Divisions are as follows: Central: H. M. Anthony, Muncie, Ind.; C. E. Darr, Detroit, Mich.; M. B. West, Lima, Ohio. New England: A. A. Hebert, East Hartford, Conn.; S. Kruse, Hartford, Conn.; H. P. Maxim, Hartford, Conn.; F. H. Schnell, West Hartford, Conn.; C. A. Service, Jr., Glastonbury, Conn.; K. B. Warner, West Hartford, Conn. Northwestern: K. W. Weingarten, Tacoma, Wash. Roanoke: none. Rocky Mountain: none. West Gulf: F. M. Corlett, Dallas, Tex.

5. This is your opportunity to put the man of your choice in office as the representative of your Division. Members are urged to take the initiative and file nominating petitions immediately.

For the Board:

K. B. WARNER, Secretary.

Hartford, Conn., Jan. 2, 1924.

ELECTION NOTICE

To All A.R.R.L. Members Residing in the Atlantic, Dakota, Delta, East Gulf (includ-

ing Porto Rico), Midwest, and Pacific (including Hawaii) Divisions:

1. You are hereby notified that an election for a new A.R.R.L. Director, for a term of two years, is about to be held in each of the above Divisions, in accordance with the new A.R.R.L. Constitution and By-Laws, which were published in the membership edition of February, 1924, QST for your information. Your attention is invited to Sec. 1 of Article IV of the Constitution, providing for the government of A.R.R.L. affairs by a Board of Directors; Sec. 2 of Article IV, defining their eligibility; By-Laws 12, 13, 14 and 15, providing for their nomination and election; and particularly By-Law 27, which especially for this election stipulates dates differing from those specified in the other By-Laws cited.

2. The election will take place during the month of April, on ballots which will be mailed from Headquarters in the first week of April. The ballots for each Division will list the names of all eligible candidates nominated for the position by A.R.R.L. members residing in that Division. There will be one Director elected from each Division.

3. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members living in any Division have the privilege of nominating any member of the League in their Division as a candidate for Director. The following form for nomination is suggested:

(Place and date)

*Executive Committee,
A.R.R.L. Headquarters,
Hartford, Conn.*

Gentlemen:

We, the undersigned members of the A.R.R.L. residing in the _____ Division, hereby nominate _____ of _____ as a candidate for Director from this Division, for the election of April, 1924.

(Signatures)

The signers must be League members in good standing. The nominee must be a League member in good standing, and must be without commercial radio connections. His complete name and address should be given. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the first day of April, 1924. There is no limit on the number of petitions that may be filed.

4. Under the former constitution of the League, Directors did not represent specific territories. However, those now occupying the office of Director from the above-named

March, 1924

Divisions are as follows: Atlantic; H. A. Beale, Jr., Parkesburg, Pa.; G. L. Bidwell, Washington, D. C.; V. F. Camp, Brightwaters, N. Y.; C. H. Stewart, St. David's, Pa. Dakota: none. Delta: none. East Gulf: none. Midwest: none. Pacific: A. H. Babcock, Berkeley, Calif.

5. This is your opportunity to put the man of your choice in office as the representative of your Division. Members are urged to take the initiative and file nominating petitions immediately.

For the Board:

K. B. WARNER, Secretary.

Hartford, Conn., Jan. 2, 1924.

**TO ALL A.R.R.L. MEMBERS RESIDING
IN THE DOMINION OF CANADA, NEW-
FOUNDLAND, AND LABRADOR:**

1. You are hereby notified that an election is about to be held for a new A.R.R.L. Canadian General Manager, in accordance with the new A.R.R.L. Constitution and By-Laws, which were published in the membership edition of February, 1924, *QST* for your information. Your attention is invited to By-Law 26, defining the policy of the League in Canada; Sec. 1 of Article IV of the Constitution, providing for the government of A.R.R.L. affairs by a Board of Directors, of which the Canadian General Manager is a member; Sec. 2 of Article IV, defining the eligibility of Directors; By-Laws 23 and 24, specifying the duties and authority of the Canadian General Manager; By-Laws 20, 21 and 22, providing for his nomination and election; and particularly By-Law 27, which especially for this election stipulates dates differing from those specified in the other By-Laws cited.

2. The election will take place during the month of April, on ballots which will be mailed from Headquarters in the first week of April. The ballot will list the names of all eligible candidates nominated for the position by League members residing in Canada, Newfoundland and Labrador.

3. Nominating petitions are hereby solicited. Ten or more A.R.R.L. members living in the Dominion of Canada, Newfoundland or Labrador, have the privilege of nominating any Canadian member of the League as a candidate for Canadian General Manager. The following form for nomination is suggested:

(Place and date)

*Executive Committee,
A.R.R.L. Headquarters,
Hartford, Conn.*

Gentlemen:

We, the undersigned members of the

A.R.R.L. residing in the Dominion of Canada, Newfoundland or Labrador, hereby nominate _____ of _____ as a candidate for A.R.R.L. Canadian General Manager, for the election of April, 1924.

(Signatures)

The signers must be League members in good standing. The nominee must be a Canadian member of the League in good standing, and must be without commercial radio connection. His complete name and address should be given. All such petitions must be filed at the headquarters office of the League in Hartford, Conn., by noon of the first day of April, 1924. There is no limit on the number of petitions that may be filed.

4. Mr. A. H. K. Russell, of 234 Westmount Drive, Toronto, Ont., is the present Canadian General Manager.

5. This is your opportunity to put the man of your choice in office as the Canadian member of the A.R.R.L. Board. Members are urged to take the initiative and file nominating petitions immediately.

For the Board:

K. B. WARNER, Secretary.

Hartford, Conn., Jan. 2, 1924.

**U. S. Civil Service
Examination**

THE United States Civil Service Commission announces the following open competitive examination:
Radio Engineer, \$4,000 to \$5,000 a Year.
Associate Radio Engineer, \$3,000 to \$4,000 a year.
Assistant Radio Engineer, \$2,000 to \$3,000 a year.

Receipt of applications will close March 11. The examinations are to fill vacancies in the Signal Service, McCook Field, Dayton, Ohio, and Camp Alfred Vail, N.J., at an entrance salary of \$2,000 a year, plus the increase of \$20 a month, and vacancies in the Federal classified service throughout the United States at the salaries indicated above.

Full information and application blanks may be obtained from the United States Civil Service Commission, Washington, D.C., or the secretary of the board of U.S. civil-service examiners at the post office or custom-house in any city.

Radio Frequency Amplification

Stuart Ballantine*

This article is very much out of the usual. The editor does not remember seeing anything quite along the same line. A careful reading will give an understanding of four matters as follows:
 The methods used in designing r.f. amplifiers.
 The uses of regeneration in r.f. amplifiers.
 The fact that regeneration does not make up for poor coils and condensers.
 The prospects of a successful short-wave r.f. amplifier.

Tech. Ed.

PRESENT-DAY methods of radio frequency amplification may be classified in the following way: regeneration, super-regeneration, cascaded repeaters (regenerative or anti-regenerative). The super-heterodyne is properly not a method of amplification but rather a method for lowering the signal frequency so that it may be more effectively amplified. The subject of super-regeneration has been worn threadbare so there is little excuse for any mention of it here.

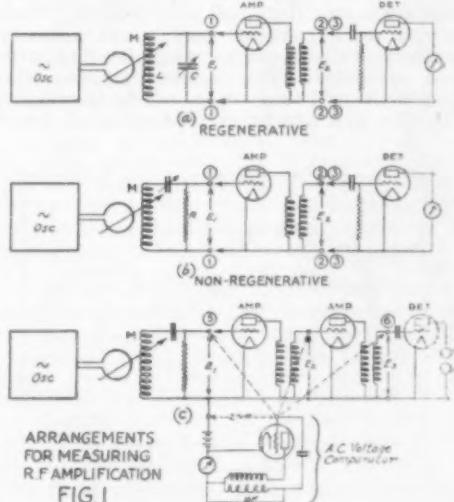
It is of course necessary to admit that there is no sharp distinction between a cascade repeater in which no special precautions have been taken to eliminate feedback action within the tubes; and the regenerative method. Such an amplifier is unavoidably regenerative and should be classified as of a combination regenerative and repeater type. On the other hand, repeater systems in which the effects of intra-tube feedback are compensated or neutralized are clearly of the true repeater type, and to these I have applied the term anti-regenerative. My colleague, Dr. L. M. Hull, has summarized in a separate article (*QST*, January, 1924, p. 12) our work with the anti-regenerative methods. This leaves two subjects open to discussion: The design of an inter-tube coupling device, and repeater type amplifiers in which the effects of regeneration are not necessarily repressed or compensated.

A great deal of controversy has centered about the subject of tuned radio frequency amplification, in the pages of this journal and elsewhere. Our old friend Mr. C. D. Tuska has something to say in *QST* for October, and in the November issue Mr. A. L. Budlong has condemned the whole method at 200 meters with unmistakable severity. The case has, however, some merit and since I am going to present this side of it I will first briefly describe how this merit is quantitatively determined in the laboratory.

Methods of Measuring R.F. Amplification

Two methods of measuring the amplification have been used: The non-regenerative method, by which the straight repeater

action alone is determined; and the regenerative method, in which the amplifier is allowed to regenerate and the contribution of this action appears in the results. Referring to Fig. 1, the regenerative method is shown schematically at (a). The amount of amplification is taken as the voltage-ratio, that is to say, the ratio of the voltage across the second tube (E_2) to that across the first tube (E_1). If a single stage is used, the comparison of voltage is made by noting the reading of a galvanometer in the plate circuit of the detector tube when the input terminals 3,3 of the detector are connected successively across the terminals 1,1 and 2,2, the accurately calibrated mutual inductor M being adjusted for the same deflection. For multi-



stage measurements a completely compensated voltage comparator is employed as shown at (c). This comparator is so designed that its input-impedance is merely that of a very small capacity, and does not disturb the conditions of the circuit under measurement. In the regenerative method the amplifier tube is connected across the condenser of a tuned *LC* circuit, and all stabilizing methods that are to be

*Author of "Radio Telephony for Amateurs."

used in the practical operation of the circuit are added. In the *non-regenerative* method the amplifier tube is connected across a *non-inductive resistance* of such small value that the feed-back into the LC supply circuit is negligible, and the voltage-ratio so obtained represents the true repeater action of the tube with its associated inter-stage coupling alone. These methods permit a complete study of r.f. amplification; the second (i.e., comparator) method is useful in designing the inter-tube coupling device *per se*, and the first is useful in designing the LC circuit, studying the various methods of controlling regeneration, and of compensation in the case of anti-regenerative circuits. The full details of this work, circuit lay-out, shielding, etc. will be given elsewhere; I have briefly outlined the experimental arrangements in order that the reader may have some confidence in the results reported later, and feel that they are quantitative and not impressionistic.

(It is perfectly easy to build such setups of apparatus as are indicated by the wiring diagram but it is the most difficult job in all radio work to build them correctly so that one is sure that the input to the first stage is actually thru the coupling coil and not thru some accidental path by induction, capacity coupling or leakage. Only after years of this type of work did Messrs. Ballantine and Hull feel sure that they had devised an apparatus that would actually measure radio-frequency amplification with good accuracy. The writer has seen the equipment and was very much impressed with the fine attention to detail. A brief

when the primary current and the position of the moving coil are known.

In working the set the detector is first connected directly to the terminals 1,1 and the movable coil of M is rotated until the detector plate-current meter gives some convenient reading. Now the radio-frequency tube is cut in ahead of the detector and the movable coil of M turned until detector plate-current meter again reads the same. Evidently the voltage to the detector is the same both times. However, the voltage in the circuit LC was not the same and the difference is very evidently a measure of the amplification produced by the r.f. tube and its transformer. How large that difference is may be determined by noting the two positions of the movable coil of M and then calculating the voltages that were induced in the secondary of M in those two positions. This explanation applies to circuits 1A and 1B.

In 1C a complete r.f. amplifier is set up and the voltage across each grid circuit is measured by the voltage comparator which is really a sort of r.f. voltmeter. The circuit of this device can readily be seen from the figure but its construction and use require skill.—Tech. Ed.)

Regeneration

The simple view of regeneration as a negative resistance, so current in radio texts, has been pretty well exploded—at least so far as its application to the calculation of regenerative amplification is concerned. It has been shown experimentally¹ and theoretically² that the regenerated signal strength depends upon the initial strength, and furthermore is not independent of the resistance of the tuned LC circuit, as the application of this idea would indicate. The ratio

Voltage amplification with regeneration
Voltage amplification without regeneration

may indeed increase with the resistance of the tuned input circuit but this should not mislead us; the signal strength after regeneration certainly decreases with increasing R to a very marked extent. In some cases this takes place in inverse proportion to R , as in Ohm's Law, but this is by no means a general law.

Now all this has a very definite bearing on tuned r.f. amplification, and in fact contains the kernel of the whole matter. It leads directly to the conclusion that for best results regeneration in such amplifiers should not be controlled by "lossers" (grid-potentiometer, series R , etc.) but should be controlled by some method of

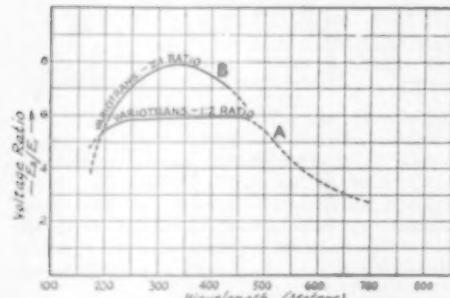


FIG. 2 NON-REGENERATIVE AMPLIFICATION CURVES FOR ONE STAGE, USING DIFFERENT RATIOS OF-TURNS IN THE TRANSFORMER.

additional explanation of the method-of-operation will be worth while.

The vacuum tube oscillator "Osc." has its output conducted thru shielded leads to the primary of the mutual inductance M . This inductance is in a way the heart of the whole device. Both coils are carefully shielded and their shape is such that the secondary voltage can be accurately foretold

¹See the curves taken by W. G. Ellis, Fig. 117, Radio Telephony for Amateurs".

²The complete mathematical theory has been worked out by different investigators, including Dr. L. M. Hull, also independently by Dr. N. Little and by Prof. E. L. Chaffee at Harvard; I hope this work will soon be published.

anti-regenerative feed-back. I do not condemn such "losser" methods as heartily as Mr. Tuska has done, for measurements and universal experience have shown that they do indeed give pretty fair results, but for best results the case is perfectly clear. I shall have more to say about this later under "Regeneration Control".

Amount of Amplification Due to Regeneration

In amateur practice the most important methods of regeneration are those employing the tickler coil and the tuned plate circuit. The latter is of greater interest in this article because later we shall connect a second audion across the tuned plate impedance for the purpose of building up an amplifier. While there is some difference in the regenerative amplification obtainable by the two methods in a given LC circuit (on account of the difference in the forward currents, grid-to-plate), the figures to be given apply roughly to both types. Also the regenerative amplification depends upon the LC ratio and R of the tuned circuit, and I have already pointed out that a high amplification ratio may be obtained in a high resistance circuit and is not a measure of the best signal strength. The LC circuit should be carefully constructed to have minimum losses, for regeneration will not completely compensate for the resistance. As to the order of the regenerative amplification, Ellis' curves (Fig. 117, my book) for spark signals show a gain of about 25 for square-law detection, which means a voltage-ratio of 5. See these curves for the effect of circuit resistance on this ratio. Hull and Snow have recently completed some measurements at Boonton using an unmodulated (c.w.) signal, measuring the d.c. change in the detector (proportional to audio frequency output for radio telephone signals), and for an average single-circuit tuner in a 14-ohm antenna at 400 meters get the following results:

Non-regenerative detector.....	1
Regenerative detector.....	25

Assuming square-low detection this gives a regenerative amplification of about 5, which checks Ellis on spark signals. For a circuit of higher resistance the regen. amp. could be increased to 10 times, but in this case the non-regenerative signal is less than 1 so the final signal strength is proportionately lower. These figures will show how important and efficacious the regenerative method is, when it is considered that the average r.f. repeater amplifier amplifies about 4 to 6 times per stage when used non-regeneratively. I have summed this up in my book in the statement that 'regeneration alone is worth from one to "one and one-half" stages of repeater amplification, (implying the total absence of regeneration in the repeater).

Repeater Amplification

We pass now to the methods of cascade amplification in which a series of tubes are linked together thru appropriate impedances. The inter-tube couplings are of various types; resistance, choke-coil, vario-

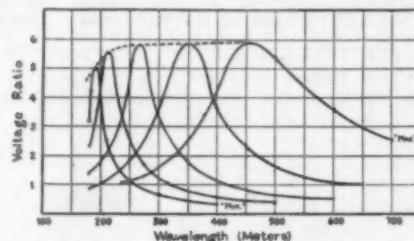


FIG. 3 NON-REGENERATIVE AMPLIFICATION CURVES FOR SEVERAL SETTINGS OF A MODEL 5 B.V.T.

Since each curve only shows results at one setting it is necessary to get a summary curve. This is done by first making curves as shown over the entire tuning range of the transformer, then running a line thru the peaks of these curves as shown in Fig. 3. At the upper end this line slants down the right hand slope of the curve gotten at the highest possible trans. tune; at the lower end it slants down the left slope of the curve gotten at the lowest possible wavelength adjustment of the transformer.

Note that this final curve is the same one that is marked "A" in Fig. 2.

meter, fixed transformer, condenser-tuned transformer, and variotransformer. For operation over a band of wavelengths and for selectivity the tuned couplings are the only ones of importance. The tuning may be done by varying the inductance, as in the variometer or variotransformer methods, or by having the inductance element fixed and using a variable condenser, as in the tuned transformer or choke-coil methods. The schemes using condensers for tuning are employed in many commercial receivers. My own experimental experience favors the method of tuning with inductance, for two reasons. First, because the higher L/C ratio gives a tuning curve which is not critically sharp and the adjustment is not so tedious as that of condenser tuning. This is a great help if regeneration is also to be used, as Mr. Budlong has pointed out in his article. Also, provided certain other circuit matters are attended to, it permits the tuning controls of the several stages to be mechanically connected together so that the adjustment may be made with a single knob. In the second place a condenser of sufficient capacity to cover a 2.1 wave-length range reduces the voltage considerably in the upper part of the scale. Of the inductance tuning methods the variometer method has already enjoyed wide use and is described in my book. It

has the disadvantage of requiring (in all stages except that immediately preceding the detector) an extra isolation condenser and grid biasing resistance, and the voltage cannot be stepped up as with the transformer.

Several years ago it occurred to me that all the advantages of the variometer method

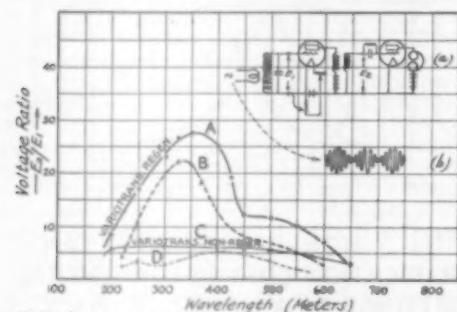


FIG. 4 COMPARISON OF REGENERATIVE AND NON-REGENERATIVE AMPLIFICATION CURVES

A—Tunable transformer regenerative.
B—Fixed transformer regenerative.
C—Tunable transformer non-regenerative.
D—Fixed transformer non-regenerative.
Note—Tunable transformer used was a Ballantine variotransformer.
The fixed transformer was an unusually good one.
The oscillator supplied sine-wave-modulated r.f.

could be retained, its disadvantages eliminated and the amplification considerably improved by replacing the variometer by a transformer whose primary, secondary and mutual inductances could be simultaneously and continuously varied over the range of wavelengths to be received. I called this device a *variotransformer*, and a witty friend supplied the abbreviation "BVT" to shorten a word which was unfortunately long. The separate windings of the BVT eliminate the isolation condenser and grid resistance which are necessary with the variometer; furthermore by providing a turn-ratio greater than unity the voltage may be stepped up. The device tunes in exactly the same way as the variometer, by means of a single knob.

Use of Iron in Radio Frequency Transformers

The effective permeability of iron at short wavelengths is small out of all proportion to the heavy hysteresis and faucault current losses. We have thoroughly studied iron cores of many types, in the form of thin steel sheets down to .001" thickness, in the form of small particles (oxidized particles, iron precipitated by hydrogen, rumpled with high resistance materials, etc.) molded under large pressure with an insulating binder, and ended up with a special core which was moulded of extremely thin "magnetic-oxide" sheets (.0002" thickness). Even the losses in this core

were too great for use at such wavelengths (600 meters) although we expect to make some use of the material in long-wave radio transformers such as are used in a superheterodyne intermediate-frequency amplifier. The idea of using iron at short waves was immediately abandoned.

Coupling

Sometimes loose coupling is used between the windings of a radio transformer having a fixed primary and a tuned secondary. This broadens the range of wavelengths over which the device will amplify. (Within reasonable limits this range then depends on the tuning-range of the secondary. There is an incidental advantage in loose coupling; if the primary turns are kept down the tendency to oscillate is decreased without using any means of compensating for feedbacks.—Tech. Ed.) However, loose coupling lowers the height of the resonance peak.

When an adjustable primary is used and the amplifier is properly compensated for feedbacks there is no purpose in using loose coupling and in such devices as the Ballantine variotransformer the coupling is made as close as possible by winding the primary and the secondary coils together.

Turn Ratio

The best turn-ratio depends, among other things, upon the plate resistance of the tube and the amount of the capacitatively-reacting feed-back from the next tube. For ordinary tubes of resistances ranging from 10,000 to 30,000 ohms a turn-ratio of 1 to 2 is about right. The sharpness of the resonance curve increases with the turn-ratio, the effect being much the same as that of increasing the capacity across the primary winding.

This is illustrated by Fig. 2. The curves represent the non-regenerative amplification of one stage with a UV-201 (C-301) tube. As previously defined this is the pure repeater action of one stage into a tube detector (UV-200 or C-300) and excludes the effects of regeneration. The higher turn-ratio (2.1/1) gives more amplification but is harder to adjust on account of the greater selectivity. The ratio 1.2/1 represents a good compromise. In the case of a "Variotransformer" this ratio gives a pretty uniform amplification of about 6 times, over the entire range of wavelength adjustment.

It seems a trifle unreasonable to present broad curves like those of Fig. 2 with the statement that one of them was obtained from a sharp-tuning transformer and the other one from a moderately sharp one. The explanation for this is given in Fig. 3 which shows how Fig. 2A was obtained.

The operation of a tuned r.f. transformer cannot be represented by a single curve, since each setting of the transformer gives a different curve. The final curve for the

transformer is the "envelope" of the separate curves; in other words it is the line passing thru the peaks of all the separate curves. Fig. 3 shows how this idea was used in drawing Curve A of Fig. 2. The separate curves that went into the making of Curve 2B were much sharper.

A non-tunable transformer, to be useful, must be designed so as to have a much broader curve; that is, the ratio-of-turns must be kept down, giving less amplification.

Regeneration Control

When a tuned coupling impedance is connected in the plate circuit of an amplifier tube it will regenerate thru the tube capacity. As resonance is approached from either side, a point will generally be attained at which the circuit breaks into oscillation. If conditions are such that this occurs very far from the resonance peak, it is clear that we will not be able to make the best use of the high impedance that the coupling offers at anti-resonance, and the repeater amplification will be defective. Furthermore, the important selectivity advantages that the tuned coupling offers, can be realized only if we operate precisely on the peak of the resonance curve. In order to get on the peak, the regeneration must be controlled.

Losser Methods

I have already mentioned that "losser" methods of control are less preferable than those involving anti-regenerative feed-back, which gets at the root of the matter. Nevertheless "losser" methods will work, and are quite easily applied. See Hull's article for a summary of these. The method of series resistance in the LC circuit is as good as any, *certainly better than biasing the grid positively* because the latter runs

The dotted curves represent the corresponding performance of a good fixed transformer and by comparison show that the advantage of tuning extends to the regenerative circuit, also that the design of the transformer for good repeater action is justified also when regeneration is to be used. The amplification reaches a maximum; and since the non-regenerative (repeater) curve is flat, this seems to be a regenerative-amplification effect. Actually this maximum can be shifted somewhat by varying the L/C ratio of the tuned grid circuit. One of the important things brought out curves of this kind is the reality of the regenerative contribution, which I originally asserted in my book was of about the same order as that of the repeater action in properly arranged circuits. At the highest point (Fig. 4) the total amplification of the BVT (see curve A, Fig. 2) is about 6. Taking Figs. 2 and 4 and comparing them, this gives an amplification of 4 due to regeneration, which falls off as the ends of the range are approached. (Be sure to notice that the amplification scale is different in Figs. 2 and 4.—Tech. Ed.) This circuit was designed for broadcast reception; both the L/C ratio and the range of the BVT were poorly adapted for 200 meters, so that the regenerative effect here is only about 1.5 times. With a proper L/C ratio and Model 6 (DX Special) BVT, the whole curve is shifted to shorter wavelengths, with a general decrease in amplitude. Regarding the suspected failure of r.f. amplifiers at short wavelengths in amplifying very weak signals, I may mention here that I have recently completed some theoretical investigations which show that this is due to the construction of the present tubes, not to the circuit. Our ex-

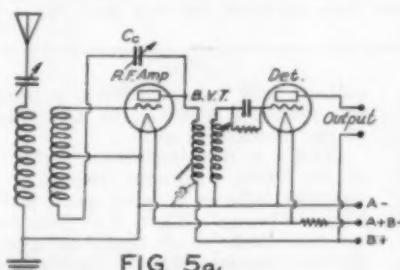


FIG. 5a

1 Stage R.F. Amplifier with Variotransformer Coupling and Regeneration Control.

down the "B" battery and shortens the life of tubes containing the new "XL" filament.

Figure 4 shows the results of measurement of the amplification (repeater plus regenerative) of a one-stage amplifier controlled by a "losser" method. An old style UV-201 audion was used, with a Model 5, BVT between this and a UV-200 detector.

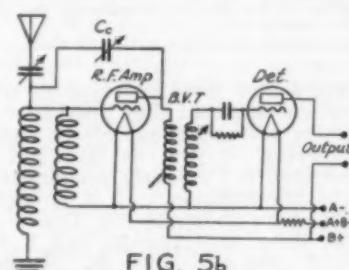


FIG. 5b

perience in the laboratory with r.f. amplification at wavelengths between 100 and 200 meters, using, however the Model 6 and not the Model 5 BVT, has been very satisfactory.

Control by Anti-Regenerative Feedback

The really proper way to control the regeneration is to provide a controllable "re-

versed" feed-back. Several schemes are available. Mr. Tuska has already explained the advantages of the reversed tickler-coil method. He used this method in connection with a capacitatively tuned coupling; it is not so successful with an inductance tuned coupling. Effective methods in this case are those shown in Hull's article (Fig. 5a and 5b), and in the present Fig. 5. For control of regeneration (rather than complete compensation) the condenser C_1 is made variable.

In Fig. 5a the coupling between the antenna and secondary coils should be close, but care should be taken to keep down the distributed capacity between the lower part of the coils if they are wound in the same direction, and between the upper parts if they are wound in opposite directions. This is very important in the case of Fig. 5b, in which the coils are wound in opposite directions. I have shown in these diagrams only one stage of r.f. amplification. Additional stages may be added, of course, and if regeneration in later stages should happen to be troublesome, the simplest remedy is a grid-potentiometer commonly controlling the extra tubes. Additional regenera-

tion in the detector circuit is less effective than might be supposed (perhaps 20% increase) and hardly worth the extra adjustment. For c.w. work the autodyne oscillation should not take place in the tuned circuit, at least in a multistage amplifier, because succeeding tubes may become overloaded. *It will probably be better to let the circuit immediately preceding the detector oscillate, or to provide a local oscillator coupled to this point of the circuit, thus heterodyning the amplified signals. This also reduces or prevents the radiation of a "carrier-wave" by the receiver.*

According to the measurements depicted above a single stage of r.f. amplification with variotransformer coupling and proper regeneration should give with square-law detection a telephone signal amplification of from 100 to 1000 times. Hull and Snow have actually measured amplification of 100 times at 400 meters, and there was some doubt here of the failure of the square-law detection so that with weak signals the 1000 mark might have been reached. At any rate the value and economy of tuned r.f. amplification is not all on paper.

How Antennaz Work

By John L. Reinartz, 1QP

Our idea of a really good radio amateur is John L. Reinartz. Reinartz isn't connected with a commercial station, a factory, a laboratory, or a university, yet his name is internationally known and his articles have been reprinted in a dozen countries. Here's the explanation: Reinartz never believes that a job is done until he has had a try, and he never admits that there isn't something in an amateur station that will do the work.

For instance—all of us had dropped the Tesla Coil as an old-fashioned toy. Then when we wanted to find out how our filters worked we began to have dreams of \$2000 oscilloscopes. But Reinartz resurrected the Tesla coil, put a bit of wire on it, and gave us the 10¢ "Moduloscope".

Lately most of us have admitted that we don't know anything about antennaz at short waves. John admitted it, too, but he immediately got out the Tesla Coil again and—but that's his story and we will let him tell it.

—Tech. Ed.

If you will follow these experiments with me you will find that they provide most interesting recreation and also a means of conveying to you, as they did to me, the need for properly proportioned circuits for transmission. It is not difficult or expensive to make the Tesla Coil and repeat these experiments, and a single "5-watt" tube will drive it. Be sure to try the things I will tell you about.

A look at Figure 1 will show the regular arrangement of apparatus used with my Tesla Coil. A simpler arrangement could be used but it is convenient to use the regular set at 1QP and simply shift the clips A and B to the Tesla primary. These clips ordinarily go to the antenna and counterpoise leads. When the set is running the current passing thru the Tesla primary induces a voltage in the Tesla secondary. Because the secondary has many turns this

voltage will be quite high, especially when the primary is tuned to the natural wave of the secondary coil.

Obtain a Westinghouse "Spark C Pencil" or an Aireo "Ignition Gauge". The little vacuum tube is a very good indicator for high voltages. When it is held near a wire or coil that is at high voltage the tube glows; we can get a rough idea of the voltage by seeing how near to the wire we must get before the tube will light up.

If you are ready we will proceed with the experiment.

Place a sheet of paper right back of the Tesla Coil, press the key of the tube set and adjust the variable condensers. If things are working right the upper end of the secondary coil will show a slight corona (or brush) discharge. Now hold the little vacuum tube as shown in Figure 2, putting it just close enough to the top turn of the

coil to get a slight glow. Make a mark on the sheet of paper to show the position of the tip of the "Spark C." Now move down an inch, slowly bring the tube toward the coil and again mark the place at which it began to glow. When you are done you will find that the curve traced in this manner will look like Figure 4. This curve, of course, shows the voltage along the coil.

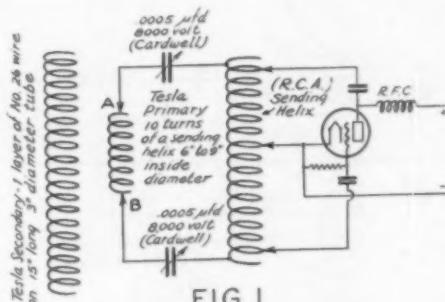


FIG. 1

there is zero voltage at the ground and it rises all the way up the coil. This is just what happens on an antenna working with a ground connection.

Now tune down the primary and keep trying the top of the coil with the vacuum tube. Soon you will strike a wavelength at which there is high voltage at the top of the coil again, but when you make a curve as before it will not be the same curve at all but one looking like Figure 5. This means that you have $1\frac{1}{4}$ wavelengths along this coil instead of $\frac{1}{2}$ wave-

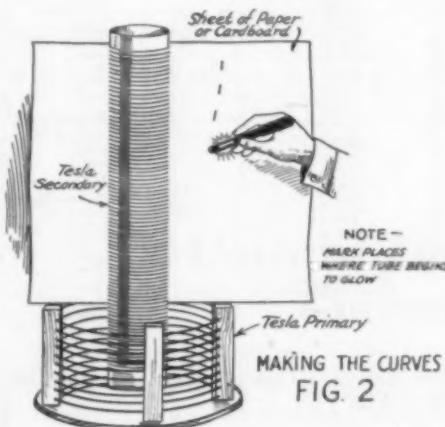


FIG. 2

length as before. This can be checked with a wavemeter; if the curve of Figure 4 was obtained with a wavelength of 300 meters the curve of Fig. 5 will be found when the primary is tuned to 100 meters.

Tuning down some more will give the 5th

harmonic with a voltage curve as shown in Fig. 6. The tune will be 60 meters if we started with a 300-meter coil.

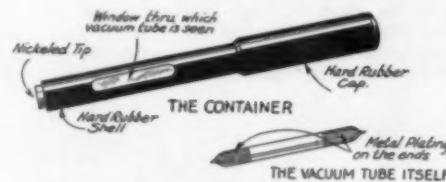
Always we will have the high voltage at the top of free end of the coil and a node or zero voltage at the bottom, or grounded, end.

The Important Point

Wherever there is a ground connection there is a node—but that isn't all. When we are working as in Figure 5 or 6 we can purposely ground the points 0, 0, 0, 0, and no current will flow thru these ground leads. Neither will this have any effect on the high voltages at the other parts of the coil.

Working An Antenna With Three Grounds

The 5th harmonic is of interest to us. Using it we can transmit right at the antenna fundamental with both ends and the center of the transmitting helix grounded. This is done as in Figure 7, the voltages



VACUUM TUBE HIGH VOLTAGE INDICATOR

FIG. 3

being such that there is a node at the center of the helix and one at each end; in other words we have one wavelength along the helix.

To explain this, refer back to Figure 6. Suppose that the part above the highest node 0₁ is the antenna, and the part below that point is the helix. This has already been found to work just as we have said that the sending set will, but there are entirely too many turns of inductance below the point 0₁, and the resistance of the circuit is accordingly very high. In order that the number of turns for this inductance may be small we will shunt a variable condenser across a portion as shown in Figure 7. This allows us to tune this part so that it will oscillate at the natural frequency of the antenna. This scheme will work and it is a good indicator of the natural wavelength of the antenna, but it does not permit easy change of wavelength, so we will pass to other experiments, using a counterpoise instead of a ground.

The Open-End Tesla Coil

With the same arrangement as in Fig. 1 but without a ground connection on the Tesla Coil secondary, press the key and tune to resonance. You will find that high voltage now appears at both ends of the secondary coil but that there is a node at the center as shown in Fig. 8. If we

started with a 300 meter wave in Fig. 4 the wave is now 150. Tuning down to the 2nd harmonic (one half wavelength) will

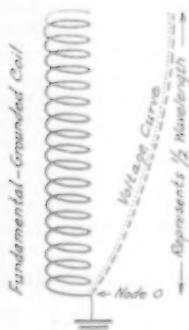


FIG. 4

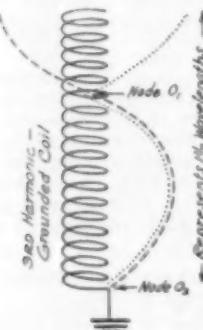


FIG. 5

give us two voltage nodes; pass this by and tune down to the third harmonic (one third wavelength) which has three voltage nodes, one in the center of the coil and

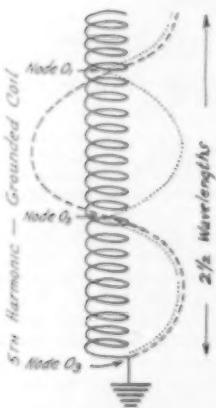


FIG. 6

one near each end of the coil. This is the wave we are going to study. The voltage curve is shown in Fig. 9.

The Antenna With Counterpoise

As in our other experiments we will assume that the part of the coil above the node 0₁ is the antenna and the part below the node 0₃ is the counterpoise. As before, this leaves too many turns in the helix (the part between 0₁ and 0₂) and we will shunt a variable condenser across the inductance so that the number of turns can be made small. In Fig. 10 this has been done and the tube set has been connected to the helix so that the filament tap comes at

the node 0₁ and there is zero voltage at both the antenna and counterpoise lead-in insulators, thus reducing the losses at these points. At the same time we have taken care of the need for a nodal point at the filament clip.

The whole system is again working at the antenna fundamental, and of course

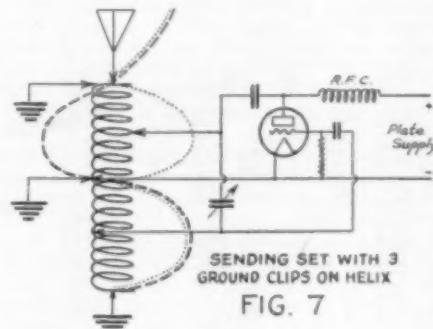


FIG. 7

the part of the system inside the station is also working at that wavelength. It might be well to say this in another way. If the antenna-and-counterpoise system works at 200 meters when their leads are connected directly together, then the thing for us to do is to set the antenna and counterpoise clips at the end of the helix, set the condenser clips about half way in toward the center and then turn the condenser until the helix system oscillates at

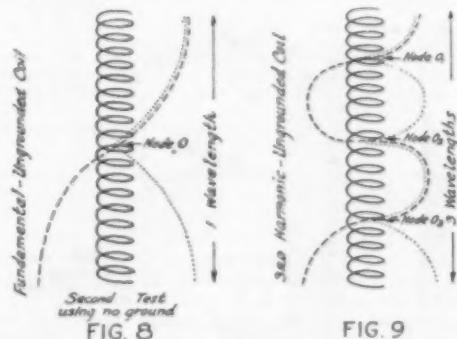


FIG. 8

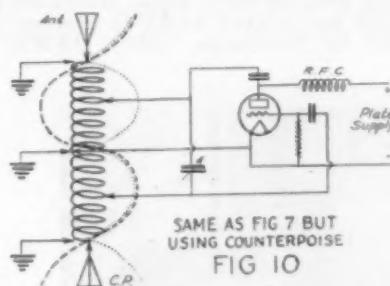
FIG. 9

200 meters. This is much the same thing as in Fig. 7.

Series Condensers

In order that we may be able to work on any wavelength within the amateur band (and below it if we have an X license), the next step is to insert two series condensers, one in the antenna lead, and another in the counterpoise lead. We will

take off the condenser that is connected across the center part of the helix and also remove the two ground connections that we put at the ends of the helix. This leaves exactly the circuit of Fig. 11, which is the one used at 1XAM and other stations for transatlantic work on short wavelengths. (This circuit was described

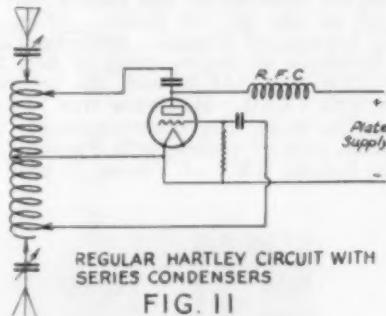


in detail on page 26 of our January number.—Tech. Ed.)

What happens in this sort of a circuit? Where are the voltages now? This too can be shown by the Tesla Coil. Supposing that we take the secondary used in the original experiment and remove two bands of the winding as shown in Fig. 12a. We now have a three-part winding. The short central part represents the helix, the air gaps represent the series condensers, and the end sections of the winding represent the antenna and the counterpoise.

Now if this coil is set into the primary just as before we will find that there is a brand new voltage curve. At first we will try to find out what this curve looks like by using the vacuum tube just as before. This will give us the curve shown in Fig. 12b. The curve here goes straight across the airgaps and pretends that the voltage is the same on both sides. *This is not correct.* To find this out make a test

as shown in Fig. 13, using an inch of wire at the end of a glass or wooden rod. A nice little arc will take place, showing



REGULAR HARTLEY CIRCUIT WITH SERIES CONDENSERS

FIG. 11

that the voltage is *not* the same on both sides of the gap and that curve 12b is *not* correct.

Very well then, what is the curve like, what really *is* going on? The fact is

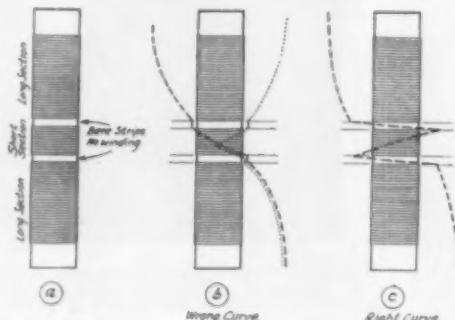


FIG. 12

that the voltage is about the same on both sides of this airgap but is reversed—or opposite in sign, a positive voltage at one side and a negative one on the other side. The real curve is the one shown in Fig. 12c.

The Onward March of Transocean Communication

JANUARY saw a great increase in the amount of two-way amateur transatlantic communication, many new stations on both sides of the ocean "getting over." In fact it has become such a commonplace now that it's going to take something a little unusual in the way of international communication to make us give up much space to it in QST. All in

all, at least 13 Europeans have worked to America and we have record of as many as 17 Americans, several of them Canadians, tying up with Europe.

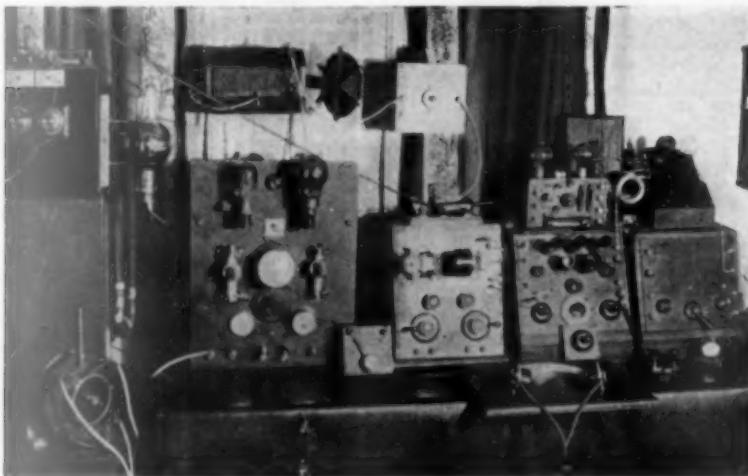
A point worthy of much speculation is that, as far as we know, all of this work has been done on waves below 150 meters, and most of it around 110 to 115 meters. As far as we have any record, no amateur

station on either side has yet succeeded in working over on 250 meters or thereabouts. This is indeed food for thought.

The big incident of the month was the arrival on the air of Italy. iACD, Mr. A. C. Ducati, of Bologna, exchanged calls and Q-signals on the morning of Jan. 25th with 1XW and 2AGB, and the following night with 1XAQ. His wave was 114 meters. He is in nice communication with England, and of course with France. Mr. Giulio Salom, i1MT of Venice, is now try-

NAB2, the QRA of which is Dr. M. Nellingman, Reeweg O. 110, at Dordrecht.

No new Frenchmen have been reported worked, altho Deloy keeps up his good work with f8AB. The British hams, however, have been hard at it and have done beautiful short-wave work. g2SZ tears in on the east coast and has worked u1XW and c1BQ. g2OD, in addition to working 2AGB with 30 watts input, increased power and has worked 9AZX in Marion, Ind., 8ZAE in Pittsburgh, 2BSC, 2AWS, and



ONE OF THE MOST EFFECTIVE OF THE BRITISH STATIONS—g2OD, operated by E. J. Simmonds, Meadowlea, Queensway, Gerrards Cross, Bucks. With 1 ampere in a 6-wire cage aerial 42 ft. high and an input of 35 milliamperes at 900 volts in a single small tube, this station worked u2AGB and was reported QSA! With increased power, 75 m.a. at 1200 volts from a 50-cycle synchronous rectifier into a 250-watt, he has worked two-way with u9AZX, u8ZAE, c1BQ, u2AWS, u2BSC, and u1CMP. The receiver is a superheterodyne. F.B.

ing to reach this country on 200 meters, using 42-cycle A.C.C.W., 500 watts. He has worked g2HF in North Birmingham nicely. We expect to hear much more of these two men.

The Dutchmen have been very active, too, about a half dozen of their stations getting over in the Tests. PA9 is the N.V.V.R. station at the Technical High School at Delft, Holland, has worked easily to u1XW, sending us greetings from our Dutch contemporary, *Radio Nieuws*, and we believe he has worked 8AVL and 2AGB too. PCII, which we gather is a "moonshine" call, is operated by Messrs. Jesse and Tappenback in Lieden, and has one of the best European signals. 2AGB, 1XW and 1KC report working him. The Dutch have unusual calls. PA9 is the only regularly-licensed one, we understand. Most of the others "roll their own" calls by using the numeral 0. An odd one well heard during the Tests was

1CMP. He is the first Englishman to work a "9" and gave 8ZAE the chance to be the first "8" to work any European country. Burne of g2KW finally tied up one night with u1KC, g2NM speared u2BSC and c1BQ, g2KF added u3XAO to his string; and g5NN, the Burndepot test station, is working u1BDI in Orono, Me., regularly, on 150 meters, we believe.

We are sorry to have to "bust" the report of f8AB at u7WT, which appeared in our last issue. It wasn't 7WT's fault. On the first night of the T/A Tests he reported a low-note modulated C.W. signal sending "PIX". It happened that f8AB's code group for that date was "PIXAK" and the time was at least close. It looked great. Then several logs drifted in reporting u9AUW, Rocky Ford, Col-
nal sending "PIX". It happened that same time and inquiring what it was all about. 9AUW verifies his transmission at

the time reported; we didn't ask him what it meant. Sorry, 7WT.

Australian Activity

Vague rumors continue to float around that an Australian or two have been heard in America, but we can't find a thin definite about it. Can anyone give us any light?

Did you read "Australian Amateur Radio Puts to Sea," in February QST?

signal: a2CM will be calling a2CDM nightly from 8 to 9 P.M. Sydney time from March 11th to April 8th, wave 210 meters, 5½ amperes in the aerial, sending an unknown 3-letter code with the calls continuously. The wave of a2CDM is expected to be 220 meters.

Reports

A.R.R.L. members are asked to drop us a line on international amateur news



WHAT IT MEANS TO BE AN EXPERIMENTER INSTEAD OF A RELAYER—Mr. Gerald Marcuse at his station g2NM at Caterham, Surrey, which has been heard in America on 200 meters and which has worked u2BSC and c1BQ on 115 meters. In the photograph, the 200m. transmitter is at the left and uses a 250-watt Mullard in a Meissner circuit, D.C. supply. In the center is a Marconi type 55D 7-valve r.f. amplifier for long waves. On the right is a home-made 8-tube superheterodyne on which any wave length may be received. The 115m. transmitter is in a separate house directly under the aerial.

Mr. C. D. Maclurcan, a2CM, Strathfield, Sydney, sails with Master Jack Davis on the S. S. "Tahiti" for San Francisco in early March with an amateur station on board having the call 2CDM, to conduct low-power experiments en route. Here is a good chance to listen for an Australian

coming to their attention, foreign stations worked or heard, etc., so that we may keep everybody posted by publishing the information.

What about working transatlantic on 200 meters? 7HG did it across the Pacific!

—K.B.W.

Antenna Series Condensers---Good and Bad

By S. Kruse, Technical Editor

THE amateur sending station today is headed toward the universal use of antenna series condensers. Now there are good series condensers, and there are very bad ones; it is worth while to know the difference.

There are several good reasons for using

series condensers in the antenna system but the best one is that one can use a large antenna and still work at waves between 150 and 200 meters. Many stations that are today operating at 200 meters could improve their output by using a series condenser and more antenna turns in the helix.

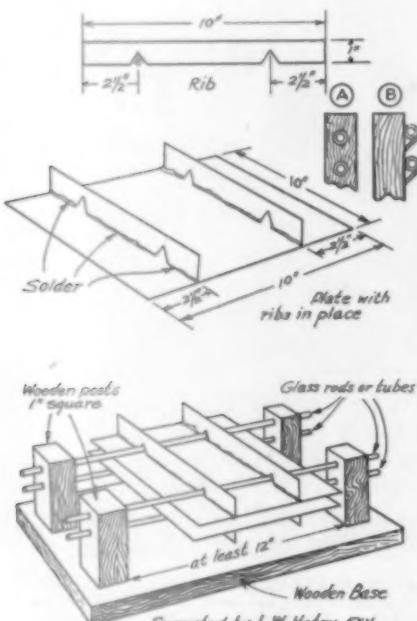
What Is a Good Condenser?

A good condenser must be used. If the condenser has high resistance the antenna efficiency will be lower and the tuning will not be sharp. The best condenser of all would be a thing insulated with air entirely, but how would one hold the plates in place? Any one can see that some solid material must be used. Now solid material always causes some losses; therefore we must build the condenser in such a fashion as to keep the solid material out of the

badly. Good glass condensers are made, in the form of copper-plated leyden jars, by the Stahl Rectifier Co. These jars were described briefly on page 65 of the November issue; their capacity is .00019 microfarads. These jars are low priced and extremely hard to puncture—the antenna current probably will never harm them.

When it comes to variable series condensers the proper one to choose depends on the antenna current. Sets using two or three "5-watt" tubes will usually operate perfectly with a good .0005 microfarad variable receiving condenser. The best condensers for this work are those with a fair amount of spacing and with rubber or thin molded bakelite ends. Condensers insulated with "moulded mud" are not good, neither are those with most of the sheet insulating-materials, especially fibre. Generally condensers with insulation in the form of a bushing around the shaft (or around the bolts) will not work well in the antenna.

For larger powers there is only one condenser on the market, as far as I know: the Allen D. Cardwell type 147B. This condenser stands up well with powers as high as four 50-watt tubes or a single



AN EXCELLENT 1.92 LOW-LOSS FIXED CONDENSER

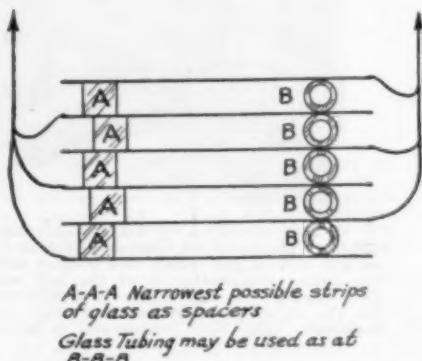
FIG. 1

space between the plates, and to make all leakage paths as long and narrow as possible.

There is not space to go into detailed descriptions on this point, it will become clearer on looking at the descriptions of the following condensers.

Factory-Built Condensers

We have just said that an air condenser will give the lowest losses. That does not mean that all condensers with solid dielectrics are bad. They may be quite good if the best mica or quartz or pyrex glass sheets are used. For small sets mica series condensers with taps at .0002, .0003 and .0005 microfarads are made by the Dubilier Condenser Co. and also by the Radio Corporation of America. These condensers are quite satisfactory at antenna currents below 2 amperes; above that they heat rather



CHEAP METAL AND GLASS FIXED CONDENSER Suggested by Brown, Darre & Basimor 38WT.

FIG. 2

UV-204. Keying surges jump across at times but the antenna current does not, and no harm at all is done.

Home-Made Condensers

In Fig. 1 is shown a condenser suggested by L. W. Hatry of 5XV. As there are only two plates they must be large to get the required capacity; in fact the design calls for plates 10 inches square. These should be cut from a good heavy sheet of tin on the square shears, not by hand, as it is necessary to have the plates flat. It is not possible to cut them with a pair of tinsnips without bending them more or less.

To the back of each plate is soldered a pair of stiffening ribs as shown. These ribs are cut from the same heavy tin and must be absolutely straight to keep the main sheets flat. Lay one of the 10" x 10" sheets on a perfectly flat table or board (be very sure that it is flat), and make two lines on the back of the sheet, using a sharp scratch-awl or needle and marking lightly so as not to bend the sheet. Now set one of the ribs in place and solder it carefully. Do not put the solder on in spots but run it evenly along the entire strip, using a good clean copper and an acid flux, or Nokorode. If you cannot do a good job of this, let the tinner do it.

When both plates have been fitted with ribs they are assembled in a wooden frame as shown in Fig. 1, using glass rods or tubes to hold them in place. The insulation is excellent as the leakage paths are very long and very slim. The exact size of the glass does not matter; it may be anything from $\frac{1}{4}$ " to $\frac{1}{2}$ ". Suitable tubing generally can be bought from a drug store or from the chemical laboratory of a school or college. The finished condenser may be mounted flat as shown or it may be tilted forward, so that the plates run up and down.

If the rods are long enough the condenser capacity may be varied by sliding one of the plates along the rods. In that case the glass rods had better be at least $\frac{1}{8}$ inch outside diameter.

See Table B for capacities of such condensers.

A Hurry-up Condenser

When a condenser must be built in a hurry the variety shown in Figure 2 is often useful. The losses are not as low as those in the 5XV condenser, but the main objection to this sort of condenser is that it is more likely to spark over because of the pieces of glass between the plates.

One advantage is that more than two plates can be used and almost any capacity gotten. Using plates 7 inches square and spacing them with pieces of $\frac{1}{4}$ inch glass tubing the capacity will be as shown in Table A. This condenser will flash over at about 8,000 volts.

Capacity of Air Condenser shown in Fig. 2.

Plates 7" x 7", spaced $\frac{1}{4}$ " apart.

Number of plates	Capacity in microfarads. (Approximate only)
2	.000045
3	.00009
4	.000135
5	.00018
6	.000225
7	.00027
8	.00032
9	.00036
10	.000405
11	.00045

Table A

Glass-Mounted Condensers

The ordinary glass-plate condenser is pretty poor for the antenna circuit, especially when home-made. It would not be quite so bad if Pyrex or some similar glass were used but that is not generally handy. A glass-mounted condenser with the glass in back of the metal sheets is perfectly good, however. The difference is shown in Figs. 3a and 3b.

A good fixed condenser for use in the antenna can be built as shown in Figure 3c, using a pair of 10" x 14" photo plates or sheets of window glass. Don't try to carry the idea beyond three plates; you will then have glass where it does not belong and the losses will go up. In a three-plate condenser of this sort the center plate must have tinfoil on both sides.



FIG. 3

Capacity of Glass-Mounted Air Condensers.

Glass plates 10" x 14", tinfoil 10" x 10".

Spacing between plates	Capacity in microfarads for two-plate condenser (This also fits the Hatry Condenser)	Capacity in microfarads for three-plate condenser (Does not fit Hatry Condenser)
1/4"	.00009	.00018
1/8"	.00018	.00036
1/10"	.00022	.00044
1/16"	.00036	.00072

Table B

Home-Made Variable Condensers

A variable condenser that costs just-about-nothing and still gives good efficiency was suggested by F. C. Beekley of 1WC-1AEL. It is shown in Fig. 4 and needs

no explanation. If the rig is tilted slightly there is no need for the rubber and the condenser action will be smoother.

The capacity obtained may be found from the second column of the table above, the capacity going down as the movable plate is slanted further away from the fixed plate.

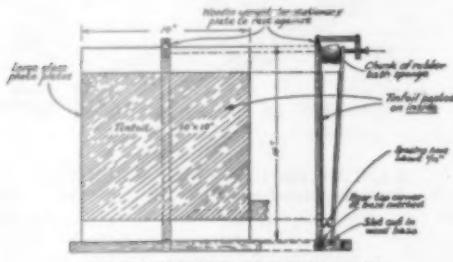
Another Home-Made Variable Condenser

When two plates do not give enough capacity the idea of Fig. 4 can not be used. For such occasions the three-plate condenser of Fig. 5 will do excellent work, even if it is a blood-brother to the old "come-and-go" condensers that used to have tin plates and wooden insulation! If the same size of plate is used the capacity of such a condenser may be found from the last column of Table B just given above. Here the capacity is cut down by sliding the central plate out.

Some General Rules

All of the home-made condensers are rather "big for their size." To keep down bad capacities leave 6" between the condensers and *any* other part of the set. To prevent heavy induction losses keep the condensers at least a foot from the helix.

In making any of the glass-plate condensers be sure to stick to the number of plates given. More than that will put glass into the field and the losses will go up very fast. Stick the tinfoil on with beeswax or paraffin, not with glue or shellac or anything that contains water, alcohol,



ether, turpentine or the like. Wide margins have been shown on all of the glass plates. Do not cut down these margins; in moist weather there will be leakage, even if you do not see anything happening.

If you can get hold of it use thin copper foil or aluminum foil instead of tinfoil; these materials do not tear so easily. No matter what you use it is possible to solder light flexible leads to the sheet after it is on the glass if care is taken to drip the solder on when it is just hot enough to "take". Everything must be perfectly clean first, tho, and a bit of Nokorode will help; wash it off afterward with gasoline or alcohol.

Current-Rating of Condensers

If the wavelength is known it is possible to give a current-rating for fixed condensers. This current rating is good for that particular wavelength only. For a variable condenser one cannot give a current rating unless the wavelength and the setting of the condenser is known.

Current ratings do not mean much in the case of air condensers: the only important thing is the voltage rating; that is, the

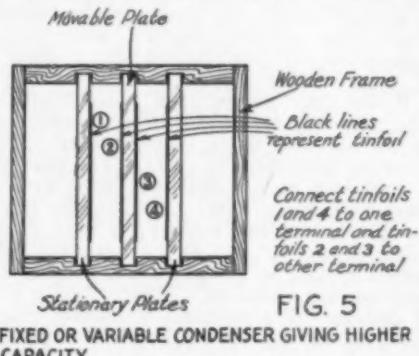


FIG. 5
FIXED OR VARIABLE CONDENSER GIVING HIGHER CAPACITY

voltage needed to spark thru the air space. This can be calculated as follows:

$$\text{Peak Voltage} = \frac{\text{Current in Amperes (1.41)}}{2\pi (\text{Frequency}) (\text{Capacity in Farads})}$$

Other formulas that amount to the same thing are

$$\text{Peak Voltage} = \frac{(\text{Amperes}) (\text{Wavelength})}{1340 (\text{Capacity Microfarads})} \text{ or}$$

$$\frac{.00075 (\text{Amperes}) (\text{Wavelength})}{\text{Capacity in Microfarads}}$$

Spacing of Air Condensers

With most amateur sending sets the flashovers that take place in the antenna condensers are not caused by the antenna current at all, but by the keying surges—the things your neighbor hears on 400 meters (or anywhere else). Cut these out and there will be little trouble along this line.

It is hard to say just what will be the flashover voltage with a certain spacing, because it depends on the sharpness of the edges of the plates, also the moisture of the air. The following are safe values.

Flashover Voltages for Air Condensers.

Conservative Values from Practice

Spacing of Plates inches	Voltage (peak)	Current that produces this (peak) voltage at .0002 mfd's and 200 meters	Current that produces this (peak) voltage at .00005 mfd's and 100 meters
1/4	15,000	21.	10.5
1/8	8,000	10.7	5.35
1/10	7,000	9.4	4.70
1/16	5,000	6.7	3.35

Table C

The table is made for C.W. To allow for A.C. plate supply divide the voltages and currents by two—another reason for D.C. To allow for a set that lets keying thumps get into the antenna—throw the table away and try it; anything can happen.

Correct Capacities for Various Jobs

When antenna and ground are used it is convenient to have a single fixed condenser of .0002 microfarads in the antenna (not ground) lead when working between 150 and 200 meters. A variable condenser of slightly larger capacity is a bit handier.

When using a counterpoise two series condensers are needed. As they are in series their capacity had better be a little larger and something near .00035 or .0004 microfarads is convenient.

For working on the "X" waves below 150 meters smaller condensers are needed. The variable condensers are handiest here



FIG. 6

and values as low as .00005 microfarads are commonly used.

For such work the Hatry condenser will give the lowest losses of those shown.

WWV At Home

By M. Adaire Garmhausen, 3BCK

The Third Radio District is inclined to get "uppy" about its performance in cornering the supply of feminine brass-pounders in the A.R.R.L. We can't blame the gang, especially right after we have gotten a new story from Miss Garmhausen or have heard her giving lessons to some ambitious young cuss who thought he could copy fast sending. If this doesn't sound reasonable, just call 3BCK some evening.

PLUNK, plunk, plunk, plunk—that's us, trudging up the boardwalk on our way to the Bureau of Standards Radio Laboratory. We felt a thrill of pride because we had found the place all by ourselves—barring the assistance of four traffic cops, two conductors, and an occasional pedestrian—and our heart was light as we plunked up the walk, admiring the rough-and-tumble woodland which surrounds the Bureau. At the gatehouse our thots were brought to an abrupt halt. Damon and Pythias, the twin St. Peters who guard the gates, were coming out to inquire our business, but we only said "How do you do?", after the manner of old acquaintances, and marched boldly past, leaving the somewhat mystified guardians gazing after us, trying hard to establish our identity.

There are several buildings, of assorted shapes and sizes, in the enclosure, but the tall aerial masts gave us an immediate clue to the one we sought, and following the path, we came, in time, to the Radio Laboratory itself, tucked neatly away over the hill, and overhung with an intricate network of wires and knobs and like paraphernalia peculiar to aerial systems. It is a long flat building of remarkably clean red brick and white stone, one story high above ground, and a railing around the top suggesting a roof garden. There are three aerials—a peachy flat-top for long waves, a peachier cage for short waves, and we think the single wire must be for receiving.

These—and a counterpoise to bring tears of joy to the eyes of the city cliff-dweller. The presiding genii, having realized that the visiting ham approaches with eyes aloft, have arranged the curb so that the unwary cannot miss falling over it. This we did with the finesse of a master, and glancing up at the darkened windows, we could imagine those within rocking with silent laughter. We entered the building in a bad humor.

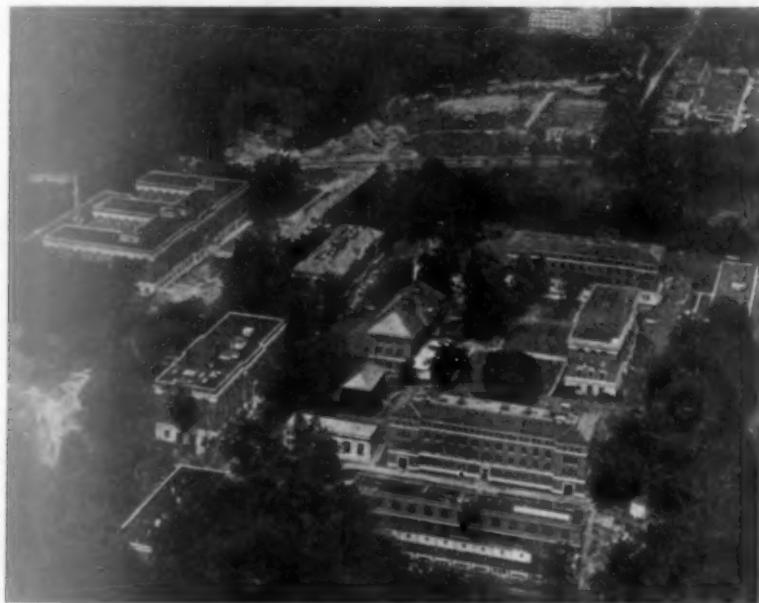
Inside dim, shiny, silence. An atmosphere fairly reeking with cerebration. We stood still in something like awe. The lobby's two walls are lined with glass cases, one containing reference books and pamphlets; the other, the Museum—pieces of extinct or unusual apparatus. Before us is the stairway, leading upward to the roof, and downward to the basement, where the Navy and the Signal Corps conduct a radio laboratory in brotherly harmony. To each side is a long narrow hall. A neat colored stenographer directed us down one of these halls, and there we found our guide.

Directly across was the room which contains the big transmitter. A good looking young man with curly hair was winding a coil, or maybe he was shining a shoe, we don't know. The young man smiled. He had nice white teeth. We took a sudden frenzied interest in WWV.

This, then, was the big noise that calibrates our receivers. It is mounted in a rack at least eight feet high by about three feet wide, containing four shelves. On the

top one is the speech amplifier with its associates. Next come three 250-watters, reputed to be doing the work of four, and a few other mysterious but necessary parts. The third shelf contains several immense antenna inductances, and the bottom shelf

ning little lighthouses, equipped with aerials after the fashion of BCK's first one. The idea seems to be to make the tubes in one lighthouse squeal intermittently, then the other takes up the wail, and a ship operator, approaching, tries to get as



Airplane View of the Bustands.
The Radio Lab. is located at the extreme right center.

holds two mammoth condensers and a row of B batteries, with more on the floor beneath. The walls of the rack are covered with meters and switches. On a table nearby stands a formidable looking receiver, while the rest of the room is littered with receivers and wavemeters, tubes and condensers, apparently ad infinitum. Everytime the young man smiled we felt our interest in WWV mount, whereas our curiosity regarding the rest of the Laboratory dwindled to nothing. We must have asked the same questions a number of times, lacking new ones. It may have been mere chance, of course, or perhaps our guide had ulterior motives, but we were uncereemoniously bundled out of the room after only the fourth explanation of the transmitter, and were forced to inspect the other rooms. They all looked pretty much alike to us—all strewn with radio apparatus of every description, and apparently all in use for one test or another. One room contains dozens and dozens of tubes of every kind. They let you look at them from behind a railing.

In the lobby is a model of the dashing waves breaking high on a stern and rock-bound coast which is guarded by two cunfar away as possible from the racket, and

so steers clear of the treacherous rocks. We can't blame him. It seems like a pretty good idea. Our guide all this time was Miss Elizabeth M. Zandonini, "OW of DC". How that girl manages to keep all that information in one head is a mystery to us. We'd have to carry a few spares, with a little card index showing which facts were filed in which head.

Coming out from that atmosphere, heavy with profundities, into the bright sunshine, brought back our buoyant spirits with a rush. We leaped lightly onto a little hillock by the road, preparatory to racing down the path, but it turned out to be a cinder pile, and we sank in up to our knees, getting our shoes full of cinders and our head full of blasphemies, and blessed if we'd swap BCK for the whole Bureau.

Concerning the 1BGF Tuner

We don't know how it happened but the number of secondary turns was omitted from the description of the tuner on page 9 of the February issue. The correct values are 24 turns for amateur work and 40 for broadcasts. The excitement displayed about that omission certainly indicates a tremendous interest in low-loss tuners.

MacMillan Expedition Nears Arctic Daybreak

IT was rather a hard job to keep the MacMillan Arctic Expedition schooner "Bowdoin," WNP, in communication with the U.S.A. during January. In spite of the fact that this month is accounted one of the best radio periods of the year, WNP's signals have been very faint and fading violently; so that, altho more reports have been received than usual, actual communication has been carried on with difficulty. It is quite perplexing to us why this should be so. Nor, indeed, have we any idea why it should be that, ever since c9BP and u7DC first broke thru the barrier and linked their



The 88-ft. schooner "Bowdoin", frozen in the Arctic ice off a barren shore. Is radio a comfort in such a location? Write your own answer. (From a photograph made by MacMillan on a previous expedition.)

respective countries with WNP, the northwestern states should hear the "Bowdoin" with more or less regularity while it is seldom that the signals are heard east of the Mississippi. One reason of course is that Operator Mix does most of his work with c9BP at a time favorable to the latter, midnight to 3 A.M. Pacific time, or 3 a.m. to 6 a.m. Eastern time when but few eastern operators are listening, but at that it seems the signals simply are not getting thru to eastern points except on rare occasions.

Again we record c9BP, Prince Rupert, B.C., as the best contact point, working Mix seven reported times in January and handling almost a hundred messages. Again u9DKB, Minot, N. D., has been second only to c9BP, working WNP four times and handling about 25 messages. u7CO and u6XAD worked him twice each. 7CO handling 3 messages; and u7OM and c4HH once each, the latter handling a dozen messages.

WNP was heard by W. L. Shiel at Dunedin, New Zealand, while working u9ZT on the night of Nov. 25th, N.Z. time. That is splendid DX. Mix also has succeeded in copying numerous European amateurs

during the Transatlantic Tests, reporting the following: French 8BM, 8ARA, 8BF, 8AZ; Dutch PCII, NAB2, PA9; British 5AT, 2ON, 6XX, 2OD, 2NO, 5KO, 6NI, 6YA, 2NM, 2KW, 2NI, 2IN, 2SZ, 2ZU. As far as we know he doesn't know anything yet about the new short-wave work, as his tuner only goes down to about 145 meters.

That Coolidge Message

As we described in our last issue, the A.R.R.L. handled President Coolidge's message of holiday greetings to the Expedition. The unknown "5" station which participated turns out to be c5GO in Vancouver, B.C., so the routing of the message was u1HX-u8ZZ-c5GO-c9BP-WNP. Barnsley handled the reply too, but as time was short he wired direct to A.R.R.L. headquarters, where it was turned over to the Radiocorp for delivery to the President, the original message having been filed with the R.C.A. Permission has been received from the White House to publish the text:

MEMBERS OF MACMILLAN EXPEDITION IN
NORTH GREENLAND DEEPLY APPRECIATIVE
OF YOUR HOLIDAY GREETINGS AND WISHES
FOR NEW YEAR ALL'S WELL ON THE BOW-
DOIN IN THE MIDDLE OF LONG ARTIC NIGHT.
MACMILLAN

Some Pretty Relaying

Station WOAW, operated in Omaha by the Woodmen of the World in co-operation with the Omaha "World-Herald" has been one of the best-heard broadcasting stations at WNP. It occurred to the station management to put on a special Christmas program for MacMillan and his men, and so the "World-Herald" asked 9DXY, Quinby, Omaha City Manager to forward a message to WNP asking for their selections. Then ensued a pretty bit of relaying. Unable to raise a 7 on the night in question, 9DXY gave the message to 9BOF in Salem, S.D., who forwarded it to 9CAA in Denver. Thence it went to 7ZU in Polytechnic, Mont., to 7ABB in Everett, Wash. 7ABB was unable to hear WNP during this particular week, so broadcast the message under a QST. It was received OK by WNP and a program immediately selected by the members of the crew and transmitted by WNP as a message to 9DKB, Minot. As 9DKB has difficulty in working into Omaha, he mailed the message to the "World-Herald." And thus a special Christmas program of their own selection was broadcast to the MacMillan party by WOAW.

—

The "Bowdoin" is now approaching the end of the long Arctic night. Already

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they have a little daylight every noon. Soon their days will be as long as their nights, and in a few months more they will be having almost all daylight and the chief difficulty will be to get the traffic off during darkness. Then when the ice breaks up in midsummer the little "Bowdoin" will turn her nose towards home, expecting to return to Main in September. That means that you fellows who want the fun of working WNP had better try hard right now.

January reports on WNP follow; unless otherwise shown, calls listed report hearing WNP.

Jan. 1, 9CDO-6BUH; Jan. 2, 1ER, c9BP sent 18 msgs., 9ASC, 9AFM; Jan. 4, c9BP sent 11 msgs., 6ALO, 9DKB; Jan. 6, c9BP sent 7 and recd. 6 msgs., 9DKB; Jan. 7, c9BP sent 13 msgs., 7MN; Jan. 8, c9BP sent 4 and recd. 14 msgs., 6CBL, 6XAD and 9DKB both worked WNP and sent press and one message; Jan. 9, c9BP recd. 9 msgs., 7MN, 5ML, 6CBL, 9CNS, 9CCK; Jan. 10, 9EFH, 6CBL, 9DKB; Jan. 11, c9BP sent 8 and recd. 2 msgs., 9DKB sent 3 msgs., 7MN, 9EFH; Jan. 12, 7CO recd. 1 msg., 6CBL, 9DKB, 6XAD sent 300 wds. press; Jan. 13, 6CBL; Jan. 14, c4HH sent 11 and recd. 1 msg., 7OM worked WNP, 9DKB; Jan. 15, 7CO recd. 2 msgs., 1CMP, 9DKB; Jan. 16, c4HH; Jan. 17, 9DKB sent 2 and recd. 11 msgs., 6CBL; Jan. 19, 7RD, c4FV, 9BSM, 9DGC; Jan. 20, 9DKB sent 1 and recd. 4 msgs., 6CDV; Jan. 21, 1AJF, 6CJQ; Jan. 24, 9EFO.

—K.B.W.

Some Good Lead-In Insulators

By S. Kruse, Technical Editor

WHEN we used spark sets a lead-in bushing had to be large—if it wasn't the thing would flash over every time the key was touched. When tubes came in, the antenna voltages dropped and everyone seems to have decided that any old lead-in would answer. This is not correct.

What a C.W. Bushing Must Do

In tube work it is perfectly possible for a poor lead-in bushing to decrease the range of a station 25% altho it does not

cause no losses to speak of unless actual fireworks took place—and even they were seldom serious. With the tube set the voltages are much less (seldom over 5,000 volts) but they "hang on" as long as the key is down and as a result the losses *inside of the insulator* may run quite high. As a result we must use a bushing of material that acts well at radio frequencies (see the article "Some tests of Amateur Antenna Insulators" on page 24, May QST*) and also the bushing must be so built that the leakage paths are "long and



THREE LEAD-INS SUITABLE FOR AMATEUR USE.

- A—Type JD7 Telefunken Lead-in. Cast iron clamping ring and rubber gaskets shown alongside.
- B—Electrose Lead-in. Type 8357-B.
- C—Pyrex Glass Bowl, to be used in Lead-ins.

show any sign of sparks or brush discharges. This was not so with the spark and it is interesting to think over the reasons.

With the spark the bushing needed to resist flashover; that was about all. The peak voltages were terrible (often 100,000) but lasted such a short time that they

skinny". Finally it is necessary, for best results, to arrange even these "long and skinny" leakage paths in such a fashion that the tendency is for the electric strains to pass thru air instead.

*Can be obtained from the QST Circulation Dept. at the regular price.

What Spark and C.W. Bushings Must Do

All lead-ins must be made to suit the fire insurance requirements which require a 5-inch distance between the incoming wire and the nearest point of the house or wall. As we understand this ruling, if a straight tube is used this means that the tube must have a length equal to the thickness of the wall or partition it goes thru plus ten inches more. When a disc or bowl bushing is used there would have to be a 5 inch distance along the surface of the disc or bowl to the nearest spot on the clamping ring or cleats.

Some Home Made Lead-Ins

The lead-ins in Figure 1 are both very bad, especially if the wall is of brick or stone. The leakage paths thru the bushing are very short and wide and the capacity to the wall is far too high. *No matter how good the material is* the high capacity makes such a bushing worthless.

The bushing of Fig. 2a has had its capacity much reduced by moving it from the wall to a thin board set in the window. This board should be waterproofed and a glazed tube ought to be used. A considerable further improvement is made in Fig. 2b by using a tube so large that the rod touches at the ends only, leaving an air space around most of its length. The ends are sealed by pouring in melted sulphur. A ring of metal or paper wadding is used at each end to keep the sulphur from running too far. (P.S. Get the family to go to the movies and wear a gas mask when you are melting the sulphur.) The bushing of Fig. 2c is still better, especially because Pyrex glass is used. See the comments on the Pyrex bushing a bit later.

Manufactured Lead-Ins

The beautifully finished porcelain lead-in of Fig. 3A is made for the Telefunken

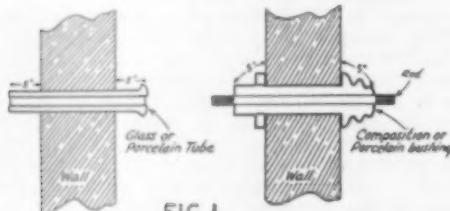


FIG. 1
THE POOREST WAY OF LEADING IN
Note the 5" dimension, required by insurance rules

Co. of Germany and must be seen to be appreciated. The metal parts are nicely made and nickel, while the porcelain body is of excellent wet-process stock with a fine gray glaze. The insulator is given a very conservative rating of 39,000 volts flashover; its length is 12 inches. The electrical flux lines mainly travel outside of the insulator between the cast iron

clamping ring and the round-edged corona-shield discs at each end. This insulator is known as the "JD7" and may, together with a number of other sizes, be obtained from H.O. Boehme at 241 Lafayette St., New York City.

Fig. 3B shows a singularly well designed insulator made by the well-known Electrose Mfg. Co. of Brooklyn, N. Y. The insulator shown is one of a family that ranges from the No. 8359-A, having a 5,000 volt rating,

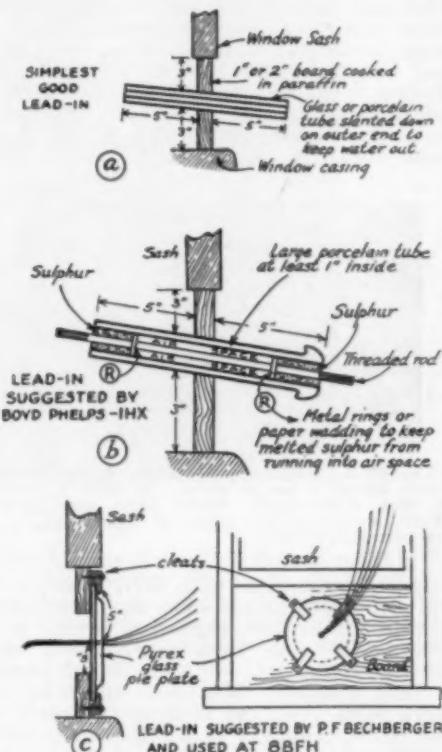


FIG. 2
GOOD HOME-MADE LEAD-INS
Notice the 5" dimensions to comply with insurance rules

to the No. 8350-A which has a 66,000 volt rating and is designed for 20 k.w. arcs on shipboard. This insulator is intended for use as a roof insulator and the cast aluminum umbrella-shaped corona shield is also a rain-shed, but excellent results will be obtained with the same lead-in in a horizontal position. It is almost impossible to hurt the insulator; it will always let go in the circular airgap at the base before flashover can damage it. No. 8357B, rated at 10,000 volts, will be about right for the average "100-watt" amateur station.

Fig. 3C shows a Pyrex glass bowl which will be used in a lead-in now being de-



veloped by the Corning Glass Co., of Corning, N. Y. Pyrex is a particularly good glass for such work as water does not

gather on it in a continuous film as it does on ordinary glass—the surface is such as to make the water draw apart and form drops.

The Second Saskatchewan Convention

Reported by c4AL

This report of the Second Saskatchewan Convention reached us just too late to make our January issue and was inadvertently omitted from our February number. It is so splendid and inspiring a report, that we are sure it is much better late than never; we are only sorry that it is late.—Editor.

THE morning of November 12th saw Regina hams meeting trains and receiving amateurs from all parts of the province. The incoming amateurs were also greeted by pouring rain which rather knocked the visiting hams with autos on the head. The morning session of the convention was spent in visiting amateur sets in the city and general discussions. Towards noon many amateurs arrived from other outlying points in spite of the bad weather. The real ham spirit could not be downed; some came as far as they could by car and finished their journey by train.

The afternoon session was attended by about forty amateurs, including one Y.L. in the person of Miss Bowen-Smith of 4AJ. The meeting opened with a short speech from G. F. Muirhead, President of the Regina Radio Club, who called on 4HH for a talk. 4HH's first subject was that of the C.R.R.L. He outlined to us the plan of the A.R.R.L. for Canadian publicity and explained that they had offered us a substantial section in *QST* solely for Canadian affairs. This would be ample for our work. The organ for the C.R.R.L. is "The Radio Bug." Mr. Brickett explained that with the amateurs of Canada in their present financial condition, it would be utterly impossible to finance an organ of their own.

"The A.R.R.L. educated us into relay work and we cannot and will not leave them. The C.R.R.L. has not asked to affiliate with them. The so-called C.R.R.L. has no policies, no constitution, and we do not know what they are or what they are doing. The amateur has nearly always started any radio magazine that has been published but after the publishers have made as much as they desire out of them the amateur has generally been left in the lurch."

The next speaker was Mr. Maynard, who spoke very highly of Mr. A. H. K. Russell, our A.R.R.L. Canadian General Manager, with whom he has had a great deal of correspondence. He says Mr. Russell is a lawyer, an ex-service man, and carries a good deal of weight in Canadian matters, and we can rest assured that the

Canadian amateur will get a square deal.

In regard to the forming of a C.R.R.L. Mr. Maynard thinks that the Winnipeg hams are sincere in regard to such a thing. But at the same time he is of the opinion that the originators started the thing with the idea of making money. He is very much in favor of sticking with the A.R.R.L. who are always willing and ready to help. In his remarks he stated that he had never in all his



9AL Toronto
Canadian Manager A.R.R.L.

life met in Canada or U.S.A. a better bunch of chaps than the members of the A.R.R.L., who were always willing to help and a real pleasure to meet. At this time Mr. Maynard gave an invitation to every B.C.L. present to come and join us. In respect to transmitting out of hours, etc., Mr. Maynard stated that for months he had listened in and had not heard any amateur in Canada or elsewhere transmitting on an illegal wave or interfering with broadcast concerts. He also expressed the willingness of all hams present to help Listener's-In in any way they could or to clear up any misunderstandings that may arise.

The next speaker was Mr. G. Muirhead who advised us that he had been

away from Regina several months and was not very well posted on the doings of the so-called "C.R.R.L.", but, as he was a member of the A.R.R.L., he was perfectly satisfied to let matters remain as they are.

When the paper named "The Radio Bug" was first formed Mr. Maxwell financed the thing and Mr. Paterson was the editor of it. However, Mr. Paterson has recently resigned for reasons best known to himself. If we all subscribed to "The Radio Bug" and Mr. Maxwell felt inclined to back out at any time we would have nothing to fall back on. As it is, there is only the good will of Mr. Maxwell. It stands to reason that one man alone cannot finance and operate any kind of a league.

At the conclusion of this a resolution was introduced by J. Brickett, Div. Manager of the A.R.R.L. to the effect that we, The Saskatchewan Division of the A.R.R.L., consider that the time is too young to break away from the A.R.R.L. and to form a C.R.R.L. This resolution was carried by the Convention.

The next item brought up was by 4HH who asked that we make out written report of the size, time of operating and all details of our sets and send it to him so that he could compile a report for QST and also get a route for relay work.

It was then moved by Mr. McDougall that the meeting be adjourned for a period of one half hour for a visit to CKCK and our old friend Bert Hooper, which was greatly enjoyed by all. Geo. Shaddick, 4BR, was good enough to explain to us the entire working of CKCK and the circuit used, which was indeed of great interest. After this visit the convention again returned to the Success College where they continued the various discussions.

The first item was in regard to co-operation with the railways. A motion was proposed by Mr. Wilkinson as follows: "That we, the radio amateurs of Saskatchewan, will do all in our power to assist the various telegraph companies in keeping communication open between points when called upon to do so: through accident or weather conditions, but that we will not under any consideration attempt to fill any breach caused by a disagreement between them and their employees except in case of distress." This motion was seconded by Mr. W. Orr and was carried.

Mr. Maynard then suggested that we give the balance of the time before the banquet to the B.C.L.'s so that they could make any remarks or present any discussions before the convention. Mr. Orr, the main spokesman for the B.C.L.'s then took the floor and was heard to remark that

after the honest-to-goodness manner in which the amateur went after things and the fair and just dealing they gave the listener-in, they wished no longer to be termed as B.C.L.'s but as amateurs and they too wanted to get transmitters going as soon as they could and get into the real end of the game. (Cries of "hear, hear!")

Radio 4HH then gave a technical discussion on wave traps and this was greatly enjoyed by everyone.

At 6:30 the gang adjourned to the Trading Co. banquet hall where they seated themselves to a large feast. Great credit is due to the Regina gang for the noble way in which the banquet was handled. The appreciation of the boys was shown by the host of empty plates. 4AJ caused a great commotion when he entered disguised as a Y.L. and commenced flirting with Dad Maynard. Professor Nuetrodyne also gave us a very interesting lecture on various radio subjects.

The toasts were as follows: To Radio—proposed by Mr. Wilkinson, replied to by Mr. Geo. Shaddick. Proposed by Mr. Cooper, a toast to International Radio; replied to by Mr. Michealis (English 5MX). It was a great pleasure indeed to have 5MX with us and get an insight on the English methods of transmission and reception. "The A.R.R.L." was proposed by Mr. Frank Meadows, who outlined just what the A.R.R.L. is and does in the Amateur Radio sphere. This was replied to by J. Brickett. Mr. Clarke proposed the Radio Clubs of Sask. which was replied to by Bill Hart, 4DG, who outlined the doings of the Prince Albert Radio Club; Dave Stewart, who told us of the Moosejaw Radio Club, and H. N. Stovin who outlined their plan of creating radio interest in Unity, Sask.; Mr. K. Muirhead also gave us an outline of the Regina Radio Club. A toast to CKCK was fittingly replied to by Mr. Geo. Shaddick who spoke in the absence of Bert Hooper, the operator. To the Y.L.'s—a toast proposed by Mr. Wilkins, was replied to by Miss For A Jay who outlined to us the advantages and disadvantages of having a Y.L. for an assistant op. Most of us had not sufficient experience in that line to make any comment. However, 4AJ claims that a seventeen-turn inductance can be wound in at least one night with the help of a Y.L.

With singing of "The King" the gang retired to the Canada West Electric Co. where they spent the rest of the evening and most of the morning. Before leaving, a hearty vote of thanks was proposed by 4HH to the Regina Radio Club for the magnificent way in which they had conducted the Second Amateur Radio Convention, which was heartily replied to by all, as everyone agreed that it was one of the finest times they had ever had.

Transatlantic Tests Report

THIRTY-SEVEN different European amateur stations were received with codes verified in the Fourth A.R.R.L. Transatlantic Tests of 1923-1924. Five other Europeans, not entered in the tests, were received without codes, making a total of 42. That is excellent, and proof conclusive of the wonderful progress the Europeans have made since the tests a year ago, when but two stations were received with certainty.

An even hundred American amateurs,

Tests (stations counted but once per night). He won by a very narrow margin over Sheldon S. Heap, 1BDT, Atlantic, Mass., with 1BCF a hot third.

The Ott Radio Co., Lacrosse, Wisc., kindly donated one of their WC5 short-wave radio-frequency-equipped tuners as a prize, but it was entered "too late to classify" in the list previously published. The judges consequently awarded it to 1BDT as an additional "consolation" prize.

PRIZE WINNERS IN THE TRANSATLANTIC TESTS

Grand Prize: Greatest Total Station Miles—R. B. Bourne, 1ANA, Chatham, Mass.

Group A: Greatest Mileage for Any Single Reception

1st:	Norman S. Hurley, 5AC, Mobile, Alabama.....	4750 miles
2d:	William Moore, 9DES, Caney, Kansas.....	4710 miles
3d:	L. W. & T. E. Bryant, 4BL, Lakeland, Florida.....	4540 miles
4th:	Quentin Swigart, 9COL, Galesburg, Ills.....	4310 miles
5th:	Fred Marco, 9CD, Chicago.....	4200 miles

Group B: Greatest French Mileage for Any Single Night

1st:	Sheldon S. Heap, 1BDT, Atlantic, Mass.
2d:	Wm. Coates Borrett, c1DD, Dartmouth, N. S.
3d:	Lafayette College Radio Club, 3YO, Easton, Pa.
4th:	Ed Scattergood, 3II, Cynwyd, Penna.
5th:	M. H. Hammerly, 2BIS, Bronxville, N. Y.

Group C: Greatest British Mileage for Any Single Night

1st:	J. L. Fenderson, c1AF, Jacquet River, N. B., Can.
2d:	Bronx Radio Club, Bronx, N. Y.
3d:	Robt. H. Sproul, 1GG, So. Hamilton, Mass.
4th:	Richard S. Briggs, 1BVL, Dorchester, Mass.
5th:	J. Van Riper, 2AJF, Passaic, N. J.

Group D: Greatest Total French Mileage

1st:	Levi G. Cushing, 1BCF, So. Duxbury, Mass.
2d:	A. W. Greig, c1BQ, Halifax, Nova Scotia.
3d:	R. W. Woodward, Hartford, Conn.
4th:	Bernard J. Kroger, 3APV, Washington, D. C.
5th:	Geo. H. Pinney, 1CKP, So. Manchester, Conn.

Group E: Greatest Total British Mileage

1st:	A. A. Learned, Providence, R. I.
2d:	A. R. Tabbut, Bar Harbor, Maine.
3d:	Boardman H. Chace, 1BDU, Winthrop, Mass.
4th:	Chester W. Sprague, 1AUC, Bar Harbor, Maine.
5th:	Harold G. Riley, 1AUR, Livermore Falls, Maine.

many of them in Canada, reported European sigs. Many, to our knowledge, did not report; but few of the stations that have worked Europe seemed to think it worth while to report the calls heard during the Tests. The total probably would have run two hundred or so.

R. B. Bourne, 1ANA, Chatham, Mass., wins the \$1,100 Grebe transmitter offered by Messrs. A. H. Grebe & Co. as a grand prize to the amateur copying the greatest number of station-miles during the entire

In making the awards of prizes the judges counted only those receptions in which a code word was copied and submitted for verification. This confines the official reception record to the Europeans formally entered in the tests and eliminates the splendid transmission of nPCII, who altho sending a code, was not entered and apparently made up his own code groups, with no way for verification. Another unusual feature was introduced into the judging by the rule that contestants

were eligible to win but one prize. When the winners were first listed with consideration only to their accomplishment and neglecting the one-prize rule, all the places outside of Group A were taken by 1ANA, 1BDT, 1BCF, c1AF, A. A. Learned, and c1DD. Then as the rule was brought into play, contestants were allowed to remain in the highest place for which they qualified but their names were removed from the other places, making it necessary to advance the remaining winners in the group under consideration and bringing in new names for the vacant places. Thus the final list of winners shown in the

2KW, 2NM, 2OD, 2ON, 2SH, 2SZ, 5AT, 5BV, 5KO, 5LC, 5NN, 5PU, 6NI, 6XX, 6YA; total 20.

French: 8AB, 8AE, 8ARA, 8AZ, 8BE, 8BF, 8BM, 8CD, 8CF, 8CS, 8CT, 8CZ, 8JL, 8LY; total 14.

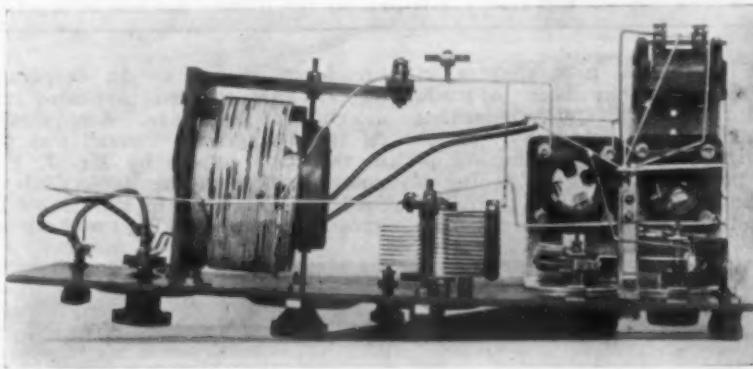
Dutch: PA9, PAODV, PAOUS, (the O is a zero); total 3.

Not entered in tests, and consequently without available verification:

British: 2KL, 2LO; total 2.

Dutch: PCII, PAR14, NAB2; total 3.

The interference from American stations was steady and deadly thruout the



THE SIMPLE SET THAT WON A BIG PRIZE FOR u1BDT, ATLANTIC, MASS.—

Built in accordance with the ideas given in December QST in "Short Wave Tuner Design". Rotatable untuned primary of 5 turns No. 14 D.C.C. wire 3" diameter. Secondary 22 turns No. 14 D.C.C. on thin paper tube 4½" diam., tuned by good variable condenser originally of .0005 mfd. but with plates enough removed to tune 90 to 260 meters, plates cut progressively to give good control of low end of scale. Rotatable tickler 12 turns No. 28 D.C.C. on 3" paper tube. Pre-war "Audiotron" detector; one step audio, using high-ratio transformer and UV-201-A tube. This tuner worked on a Beverage wire 650 ft. long pointing northeast over a salt marsh, close to edge of sea. The northeast end was grounded thru a 320-ohm non-inductive resistance to a wire buried in a creek bed. Simple enough, isn't it?

table with this article has scant resemblance to the way in which the performances originally placed, which was as follows (Group A omitted because it had no names in common with the other groups):

Group B: 1st, 1ANA; 2d, 1BDT; 3d, 1BCF; 4th, c1AF; 5th, A. A. Learned.

Group C: 1st, 1BDT; 2d, c1AF; 3d, A. A. Learned; 4th, 1ANA; 5th, 1BCF.

Group D: 1st, 1ANA; 2d, 1BDT; 3d, 1BCF; 4th, c1AF; 5th, c1DD.

Group E: 1st, 1BDT; 2d, 1ANA; 3d, 1BCF; 4th, A. A. Learned; 5th, c1AF.

The prizes, some 4,000 worth of the best American radio apparatus, were listed in detail in January QST, and information on the places in the contest appeared in the December number.

The Stations Heard

The following European stations were received with codes verified.

British: 2FN, 2FQ, 2FU, 2IN, 2KF,

tests, over 1200 interfering stations having been logged and reported to the Traffic Manager.

The Star Performers

1ANA logged 12 different British stations during the Tests, 9 French and 1 Dutch. Counting receptions of a given station but once per night, he has to his credit 56 official British receptions, 62 French, and 10 Dutch, with a total "station-mileage" of 390,460. 1BDT logged 15 British, 10 French, and 1 Dutch station; crediting him with 79 British receptions, 40 French, and 11 Dutch, with a total mileage of 388,025. The greatest mileage on British stations for any one night went to 1BDT, who logged 7 different stations with codes on the nights of Jan. 6th and 10th. 1ANA took the single-night honors on the French, logging 7 different Frenchmen on Jan. 1st.

We Win the Clock

Perhaps our readers recall that the Edi-

tor had a bet with Mr. W. W. Burnham that at least twelve Europeans would be heard during the Tests. Mr. Burnham has radioed us via g5NN and u2AGB:

CONGRATULATIONS AM SENDING CLOCK AT ONCE I WANTED THE GREEN SUSPENDERS BADLY BUT BRITISH HAMS HOPE TO GIVE YOUR GANG SOCKS SOON.

Further Reports

The analysis of the Test reports is a formidable job; work is progressing on it but no further details are available at this writing. If any particularly interesting features become evident as the analysis proceeds, further reports will be made in *QST*. —K.B.W.

Cornering That Buzzing Interference

By Perry O. Briggs, 1BGF*

Radio amateurs often can be helpful in locating radio interference caused by power lines. This should be done in co-operation with the power company, not only because the work goes faster that way, but also because they will best know how to cure any line troubles that may be found.—Editor.

FELLOW hams. A new chapter in radio reception has been opened: the hunting down and eliminating of interference caused by, or at least blamed on street lighting equipment. The proverbial job of "finding a needle in a haystack" is a cinch compared to tracing and eliminating the microscopic

broadcast programs. In desperation the electric light company appealed to the radio club for assistance. A request for data on this bothersome "buzz" was published in the local papers by Mr. J. F. Furey, now President of the Radio Club of Hartford and Chairman of the Club's Interference Committee. The request was not



The Set That Did The Work

causes of radio frequency oscillations emanating from street-light wiring.

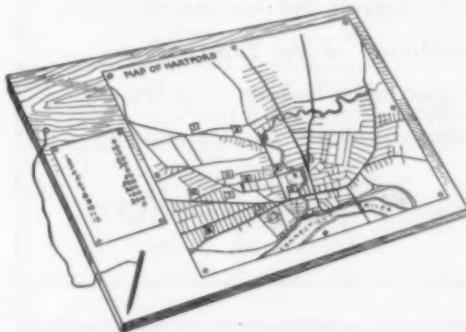
Let me now relate what has happened in Hartford the past few weeks. Since last March the Hartford Electric Light Company and local amateurs owning transmitting sets have been goaded to exasperation by "hot" letters received from broadcast listeners in the southern part of the city giving them the "razz" and blaming them for starting and maintaining a terrific "buzz" just the minute it became dark and when they wished to receive

*Interference Committee, Radio Club of Hartford.

met with any great enthusiasm; neither amateurs nor others responded at all well. However, several amateurs, especially Messrs. Furey, Schnell and Warner, tried by means of loops and radio frequency amplifiers to get a bearing on the "buzz" demon, but without avail for it was equally loud at all points. The task was abandoned for several days until the writer devised a systematic method of procedure.

A map of the city of Hartford was tacked on a board and twenty-five pins with numbered paper flags glued to them were stuck in the map at various points

in the southern section of the city. On this board also was tacked a cardboard table listing the flags in numerical order. A receiving set was then installed in the writer's car. The set is as simple as can be imagined, being the famous Hassel tuner (described in December, 1923, QST)



with a two-foot loop of eight turns in series with the secondary. Ordinary home-made two-step amplifier amplifies the "buzz." For the detector a UV-201-A is used with excellent results. The set is mounted on rubber sponges to lessen the vibration. While riding along at thirty-five miles an hour the writer has distinctly heard second, third, and eighth district stations.

Coming back to locating the "buzz." Stops were made at the various locations of the map pins and by using an audibility meter the respective audibilities were noted beside the respective numbers on the card board chart. After taking the readings and getting back to more comfortable quarters in the station of 1BGF, a curve was plotted, which was found to have a decided peak in the Washington Street district. At last it seemed that we had a clue. We lost no time in hiking back to Washington St. Running slowly down the street it was noticed that as we came into the electrostatic field of each street light the noise of the "buzz" increased steadily. It reached its peak when we came to the intersection of five streets: Washington, School, New Britain Ave., Webster and Barnard Streets.

Feeling confident that we were close on the track of the "buzz" we hastened to the home of a confirmed broadcast listener, Mr. C. T. Maloney, inviting him to be in at the "killing." With two sets of head-fones we both listened as we drove down Washington Street and both agreed that the "buzz" was at its peak at the intersection of the streets named. By mere accident the driver of the car turned into School Street—WHAM!! the "buzz" increased a hundred-fold, and as we advanced down the street it kept increasing

until we reached the second light pole where the noise in the phones was unbearable and at its peak. Being somewhat skeptical that we had located the interference we cruised down the other streets in the vicinity but found that the peak of intensity was in School Street. Mr. Maloney got out of the car and shook the light pole. The "buzz" faltered, stuttered, stopped, then came back with renewed energy. This was indeed interesting since the electric light bulb wiggled quite precariously in its socket and threatened to fall out. Rushing to the nearest telephone pay station, Mr. Maloney got into communication with a friend of his in the employ of the electric light company, who came down immediately to the location of the trouble, and after an investigation enthusiastically agreed with us that we had located the buzz in School Street.

A lineman was called and the offending bulb was plucked from its socket, but the noise continued. We were all dumbfounded but finally thinking that the street lamp bracket might have something to do with the buzz, it was reported for change. The following night we went the rounds again, being joined by several officials of the electric light company, and as before the buzz was still in operation and led us back to School street. There being only three lights on School Street the circuit was bridged by a loop of wire—but still the noise. There was only one thing to do now and it was done—the School street circuit was cut off entirely. *The noise stopped.*

The following day the Hartford Electric Light Company went to the expense and trouble of tearing out the School Street lighting circuit and installed new wire, insulators, goosenecks, and bulbs, and in the evening when the lights were turned on the troublesome "buzz" was missing and has not been heard since. As to its cause we are all in the dark. The apparatus which was removed from School Street has been given a thorough laboratory test by the light company but no cause for the "buzz" was located. Altho it is generally agreed that it was caused by a spark discharge, the point of discharge has not been found.

We are on the track of another disturbance and we hope to locate the cause before calling on the electric light people to go to the expense of tearing down a lot of apparatus when perhaps the trouble is caused by some minor defect which could be readily remedied.

In most cases the electric lighting companies in other cities as well as in Hartford will heartily co-operate with interference locators and gladly eliminate all trouble of this nature brought to their notice.

Important Notice to All Members and Readers

Information Service Suspended During Reorganization

The A.R.R.L. Information Service will be suspended for one month, starting March 5th.

This is being done to allow the organization of the Experimenters' Section to proceed more rapidly.

After April 5th service will be resumed under definite rules which will be announced in the April issue of QST.

Questions mailed between March 5th and April 5th will not be answered.

S. Kruse, Technical Editor, QST

H. F. Mason, Department Editor, QST

Annual New England A.R.R.L. Traffic Convention, Hotel Kim- ball, Springfield, Mass., March 28-29, 1924

TWO days of real ham fun and fellowship! You can't afford to miss the stunts, entertainment, prize contests, technical and traffic meetings.

There will be Department of Commerce examinations for those who are ready to take out licenses.

There will be an initiation into the famous Royal Order of Wouff-Hong—a chance for all New England hams to get into this wonderful fellowship order.

The "OW" and "YL" are especially invited—special entertainment for them—bring 'em along!

Tickets are \$4.50 each and reservation should be made not later than March 23rd. Make reservation with A. S. McLean, 288 Main St., Springfield. Further information can be had from the same address.

SECOND DISTRICT CONVENTION AND SHOW

March 3d to 7th, New York

The Fourth Annual Second District Radio Show and Convention, under the auspices of the Executive Radio Council, will be held in the Grand Ballroom of the Hotel Pennsylvania, March 3 to 7, 1924, inclusive. There will be fifty exhibits of apparatus, a big ham banquet on Wednesday, March 5th, and a "R.O. Wouff-Hong" initiation on the night of the 6th, with contests, lectures, stunts and hamfests thruout the program. Further information can be obtained from the Council, 120 Liberty St., New York. Make your reservation at once.

All amateur radio mourns the death on January tenth of Samuel S. Frizzell, A.R.R.L. member and 1SF-1UD. He had just signed off for the night at 1CRW-1ZA and was on his way home when he was struck by an automobile, sustaining injuries which proved fatal the following afternoon. Sincere regret at his passing is expressed by all who knew him and his signals will be sadly missed by all amateurs in and around Boston.

WWV Schedules

Every day there are fewer amateurs who do not know their sending wavelengths with exactness. The reason is the continuation of the "Standard Frequency Transmissions" from station WWV, at the Bureau of Standards at Washington, D.C.

The service costs nothing, and it continues to grow more popular especially and particularly with the members of A.R.R.L.

The next schedules are given below; they can be heard and used at most points east of the Mississippi River and at many beyond.

The signals are of use in testing receiving sets, checking wave meters and adjusting transmitters. The accuracy is better than 3/10 of 1%. This is much better than the accuracy of any wave meter the average amateur will ever own.

Information on using the signals was given in the February 1923 issue of the Radio Service Bulletin, also in the following places in QST—July, 1923, page 28, "U.S. Will Send Standard Waves for A.R.R.L.;" May, 1923, page 47, "Laboratory Oscillators." More detailed information
(Concluded on page 53)

DID YOU SERVE IN RADIO DURING THE WAR?

An Urgent Request to Amateurs to Supply A.R.R.L. Headquarters with Vital Information Needed for Statistics—Please Read This Carefully and Fill Out the Questionnaire at Once.

HOW many amateurs gave their services to their country in radio work during the late war? We have a pretty fair idea but we can't prove it. Who were they? What jobs did they hold, where, how long, what branch of the service?

Now get this: This information in proper form, can be invaluable to A.R.R.L., as it is proof of our value to our country and evidence of the benefit of amateur training. We need this information right now, for use on behalf of American Amateur Radio, and we will need it more in the days to come. Once before we ran a little request for this information in *QST*, shortly after the war, but the response was small, and many men whom we personally knew to have served in radio were too modest to report it. We really need the stuff, men, and this is a plea for your cooperation—a request that you fill out this form regardless of whether you reported before and regardless of whether you are personally known to some of the folks at Headquarters. We want everybody, so see that your friends and your club members act too. Our many thanks!

IF YOU SERVED IN RADIO DURING THE WAR, PLEASE GIVE US THE FOLLOWING INFORMATION

Name in full.....

Present address in full.....

Were you an amateur before the war?..... Station call?.....

If you held an operator's license before the war, what grade?.....

Did you serve in the Army, Navy, or Marine Corps?.....

In what branch of that service?.....

Where did you enlist?..... When?.....

List the successive ratings or ranks held by you.....

How long did you serve?..... How much of this time, if any, was overseas?..... Were you wounded?.....

Cited?..... Decorated?.....

Please state the chief capacity in which you served, such as operator, instructor, mechanic, executive, etc.

If you attended a government radio school during the war as a student, give place and dates.

In the following space please state briefly the various assignments held by you in actual radio work, giving duty, outfit, location, approximate dates, and rank at time, *underlining the most important duty*.

If you are willing to help us in this matter, please append a list of all the amateurs you can recall who served in radio in the late war, provided you can supply their present addresses or calls. We'll write to them.



Amateur Radio Stations



8BDA Parkersburg, W. Va.



A small unobtrusive wooden shack on Quincy Hill, overlooking the Ohio river at Parkersburg, West Virginia, houses 8BDA. Nearby is a ninety-foot pipe mast with the antenna, two six-wire cages 100 feet long, dropping down to the shack at about 45 degrees. Beneath the antenna is the counterpoise of twelve wires, used exclusively because the ground is too sandy to obtain a good ground connection.

Part of 8BDA is a remnant of the spark days, for the spark set is still in the station, ready for immediate use. It is rarely used now and is kept mainly for emergencies when communication must be established with the least possible delay. This spark set was described in the article on page 35 of the December, 1922, QST. A United Wireless 1K.W. coffin, a condenser with half-inch plate glass and cop-

per sheets immersed in oil, a synchronous spark gap with a Hyrad disc, and a "split" type oscillation transformer are the essentials. The antenna current is 8 amperes.

There are several who operate the station, but the license is issued in the name of Edw. Garrison, 515 10½ Street, Parkersburg, West Va., and communications addressed to him will reach the station without delay.

On the table near the spark set is the C.W. transmitter, using two 50-watt tubes, connected in the reversed feedback circuit with plate current supplied through a 60-jar rectifier and filtered. The antenna current is normally about 6.6 amperes on 200 meters.

A Reinartz tuner, slightly modified, and a one stage audio amplifier, constitute the receiving equipment. A wire 125 feet

long at right angles to the big antenna is used for receiving and the connections are such as to allow break-in operation.

As for records, the spark transmitter has been reported 50 feet from the phones at 7IY near Seattle, Washington, on a Beverage antenna, detector and two stage audio amplifier; besides being heard in all



The old and new at SBDA

districts, 1,000 miles south of San Diego in the Pacific, 2,100 miles at sea in the Atlantic and in Porto Rico, Panama, and Cuba. 8BDA's C.W. signals have been heard by amateurs in 46 states, all Canadian provinces, Hawaii, Panama, Porto Rico, Cuba, Alaska, and several times by ship operators aboard ships in the Pacific and Atlantic Oceans. Stations in every district have been worked. 8BDA is always QRV for your traffic.

6LV, San Mateo, Cal.

"QSR anywhere, anyplace, anytime" is the motto of 6LV. Here is a 6th district station which is heard consistently throughout the U. S. almost every time the key is pressed. Wm. Baker is the owner, builder and operator, and the station is

located at his home at 235 7th Ave., San Mateo, Calif. The signals of 6LV have been heard in practically all states and Canadian provinces and also in Alaska, Mexico, Hawaii, and New Zealand. The average monthly traffic participation is about 150 messages.

The receiver is a three-coil honeycomb set with a detector and two-stage audio amplifier above it. Amateur signals from every district are copied quite regularly on the detector tube only, however. The transmitter uses two 50-watters in the Hartley circuit. An Acme 600-watt transformer furnishes 1000 volts which is chem-



ically rectified, then filtered and applied to the plates.

The antenna is not all one could wish for as it is rather small and completely surrounded by oak trees. It is a four-wire flat top 45 feet long and 65 and 55 feet high at the ends. The lead-in is taken from the lower end. The counterpoise, directly beneath it, is a 7-wire fan 70 feet long, 10 feet high, and fanned out to 24 feet at the far end. The antenna current is between four and five amperes.

8ZD-8VE, Pittsburgh, Pa.

Radio station 8ZD-8VE is owned and operated jointly by P. E. Wiggin, old 8XH, and F. B. Westervelt of 8VE, and is located at the home of the latter at 5306 Westminster Place, Pittsburgh, Penn. The station is in a basement room about fifteen feet square. The walls are painted white, heat is provided by a furnace in an adjoining room and everything is arranged for the convenience of operators and visitors who come to pound brass in the early hours of the morning.

On the right of the table is the main transmitter which employs five 50-watters arranged for C.W. phone or chopper. When phone is used the Heising system of modu-

lation is employed, two 50-watters acting as oscillators, three as modulators and a 5-watter as speech amplifier. The Hartley circuit is used. Plate current is furnished by a Westinghouse 1,000 volt motor-generator set under the table. The filaments are supplied with A.C. On the front of the panel are meters for indicating values of, D.C. plate voltage, antenna current, oscillator grid current, modulator plate current, filament voltage, oscillator plate current, and modulation. The filament rheostats are located on each side of the modulation meter and the switch below is for changing filament voltmeter from the oscillator tube circuit to the modulator

tube as each has separate rheostat control. The other two switches break the 110-volt 60-cycle A.C. lines to the filaments and motor-generator set. Power to the station is supplied direct to the operating room by a three wire 110-220 volt line capable of standing a 200 ampere load, so there is "power to burn."

A traffic record was also established in the handling of 2855 relay messages between February 15th and March 15th of last year. On the call, 8ZD, only D.C.C.W. is employed, while phone, chopper, I.C.W. or A.C.C.W. may be used on 8VE.

"If it can be QSR'd it will be" is the motto of this station.



To the left of the transmitter is the send-receive switch which starts and stops the motor generator set, closes the filament circuits and transfers the antenna and counterpoise from receiver to transmitter.

The receiving apparatus consists of a Westinghouse RC set that has been altered to cover the wave length band between 85 and 275 meters. To the left of the RC set is an old C.R.L. Paragon with detector and two-stage amplifier. Baldwin and Western Electric phones are used when headphones are desired while a Callophone (loud speaker) may be used at times on strong signals.

On the other side of the room is equipment arranged in regular ham style for rapid changes in circuit. A 500-watt experimental tube is used at times in this set-up. A good wavemeter and other experimental apparatus are also in the station and come in handy.

The antenna consists of two 6-wire cages 6 inches in diameter and spaced about 10 feet apart. It is 70 feet high and 65 feet long and is used in conjunction with a 10-wire fan counterpoise. The antenna and counterpoise lead-ins are brought through holes in the window panes directly above the change-over switch.

The transmitter first described, using one 50-watt tube with pure D.C. plate supply, was used at 8ZD last winter and worked every state with the exception of two, and was heard in every district, Canada, Panama, Porto Rico, and in England.

Book Review

By S. Kruse, Technical Editor

"Henley's 222 Radio Circuit Diagrams", by John E. Anderson, M. A.; Arthur C. C. Mills; Elmer H. Lewis, Radio Instructor, East Side Y. M. C. A., New York City. The Norman W. Henley Publishing Co., New York. \$1.00.

The "circuit hound", whether receiver or sender, will revel in this book. The 222 circuit diagrams are cleanly drawn, nicely labeled, and up to date. More than that, the book is logically arranged, it begins at the beginning and explains the first steps briefly but clearly, then goes ahead to the next thing. To this is added a "list of symbols", a code chart, some general information on tubes and coils, and three excellent little chapters that explain the "Art of Reading Diagrams", the care of batteries, and the conversion of wavelengths to frequencies. At other points in the book there are treated: tuning, the requirements of the fire underwriters, and the construction of loops and antennas. Taken all together it is an excellent little book and one well worth having.

"The Outline of Radio", by John V. L. Hogan, Consulting Radio Engineer, Fellow and Past President I.R.E., Member A.I.E.E. Little, Brown & Co., Boston. \$2.00 net.

It is a real pleasure to review this book, because one can say pleasant things about it. No better introduction can be given than by quoting from the preface of the book itself: "If you are weary of radio publications, take heart. Beneath the froth of writing that has been stirred up to meet (but hardly to satisfy) the wants of radio users, there exists a substantial literature of the art and science....A large part of the material recently published has already been forgotten, for it was neither accurate nor readable. However, the fact remains that radio is accomplishing great

(Concluded on page 47)

INTERNATIONAL Amateur Radio

Pan-American Tests

May 19th to 31st, inclusive, are the tentative dates for transmitting and receiving tests with amateurs of Central and South America. These dates are subject to change, however, and when arrangements are completed the exact dates with further information will be announced through *QST* and the weekly A.R.R.L. broadcasts. The tests probably will be divided into two parts each night so that amateurs of both North America and South America will have an opportunity to transmit and to receive.

These tests are about the biggest thing in the way of tests that the A.R.R.L. has yet tackled. We are arranging tests with amateurs who almost without exception do not speak our language and who, being situated in the tropics and southern hemisphere, encounter radio conditions quite different from what we are used to. The question of the best time of year to hold Pan American tests is a difficult one to answer, for when it is wintertime in North America it is summertime in South America and vice versa. In other words good radio conditions do not exist in the two continents at the same time. We all hope the May tests will be successful—and they will be if we all start preparing for them now and have our transmitters and receivers as perfect as we know how to make them by the time the tests are to begin.

By far the greatest interest is being shown by the Argentine amateurs. In fact it was they who first proposed the tests. At least twenty or thirty with powers averaging around 150 or 200 watts (manufacturer's tube ratings) will take part. They wish to transmit on wave lengths between 200 and 400 meters, but we know from experience that the shorter wave lengths are much better, so are recommending that they transmit on wave lengths between approximately 100 and 200 meters. In the meantime they are also perfecting their short wave receiving equipment.

All amateurs in Brazil, Chile and other South American countries are likewise invited and expected to take part in the tests. We are also endeavoring to get in

touch with interested amateurs in the Central American Republics. Do any of our Mexican amateurs know of any amateurs to the south of them? Porto Rican and Cuban amateurs can hardly wait till the tests start so they can show their ability to act as a relay point between South America and the U. S.

The headquarters of the Traffic Department received dozens of cards from amateurs who saw the notice on page 44 of the January *QST* asking for the names of amateurs familiar with Spanish or Portuguese. For some curious reason most of the replies came from California. C'mon, Texas, the gates are still open!

Another thing: how are you coming on your study of Spanish? Mexico City (XDA) sends Spanish press on 4000 meter spark somewhere between 9 P.M. and midnight C. S. T. You cannot fail to hear him almost anywhere in the U. S. on one tube and his even sending is excellent for code practice.

Hollander Hears 'Em All

Imagine yourself in a country where it is practically impossible to obtain a piece of C.W. equipment and where the government prohibits amateur communication. This is the situation in Holland. Even so, enthusiasm among amateurs there is at a high pitch and there would probably be dozens of stations on the air if it were possible to obtain transmitting parts. As it is, it just seems as though there are no things such as transformers, high voltage generators, copper strip and high voltage condensers. Amateurs, therefore, must turn all of their attention towards receiving. Some excellent results are obtained.

A particularly well equipped and neat receiving station is that of Mr. J. C. Nonnekens, shown in the accompanying photograph, who with his three receiving sets is able to hear almost anything on wave lengths up to 23,000 meters. In the background on the left is a set employing two r.f. amplifiers with tuned primaries and a regenerative detector. Phillips double-grid tubes, requiring six volts on the plate, are used. In the center of

the picture is a "Marine" receiver built by the Netherlands Radio Industrie, a most selective receiver with a wave length range of from 400 to 23,000 meters. The lower cabinet contains the tuning apparatus and the upper cabinet the tube control' apparatus and plate variometers for oscillation. All inductances are either bank wound, or wound in slots. Results are very good; NSS, WII and WQC come in on one valve regularly. The little set on the right is the one on which the most

number should be doubled. We have trouble in getting our logs in, however, for we have no national organization like the A.R.R.L. to work up enthusiasm over the tests and collate the results. Therefore, what has been done so far has been accomplished entirely by individuals. I was talking to one of our leading amateurs the other day, and he mentioned casually that he had recently heard about 40 Yanks in a single evening! But he said he never bothered keeping a log and had



A Dutch Amateur, J. C. Nonnekens, At His Set

stations are copied. It is a short wave set using Corona coils, also manufactured and patented by the Netherlands Radio Industrie. Schenectady (WGY) comes in on one tube every night when conditions are not too bad. One r.f. amplifier is used at times, otherwise the standard three-coil circuit is used. Using detector only a number of amateurs have been heard, among them being 1AW, 1BCG, 1BCT, 2SZ, 2TJ, 3BT, 8TT, 8ATB, 9APE and Canadian 1AR and 3XN. The last-named is one of the strongest. Many of these can be heard clearly through the loud speaker when two a.f. amplifiers are used.

Short Waves the Key to T-P Work N.Z.-Hawaiian Tests Partly Succeed

By F. D. Bell, N.Z.4AA

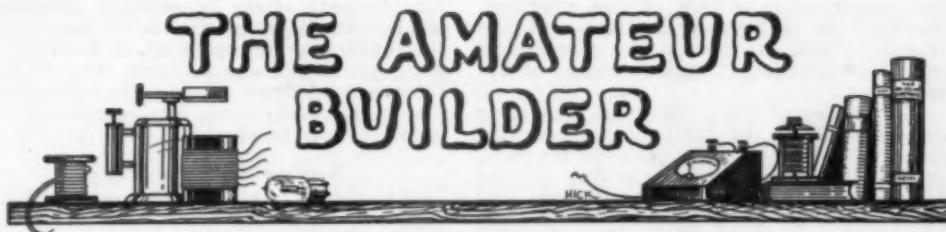
The second Transpacific Tests have been successfully concluded. I understand that over 200 American amateurs were heard in Australia alone and, by the time the New Zealand logs have been sent in, that

probably misplaced the paper they were copied on. However, he promised to send his lists to *QST* in the future.

Apparently no Australasian transmitting stations were heard either in Hawaii or on the mainland during the tests. This is not hard to understand for I am quite sure that your receiving conditions are not near as good as ours. Provided that our stations kept well below the congested band centering around 200 meters and put out currents of three amperes or more I believe we will have an excellent chance of being heard there, but on 200 meters I do not believe we could break through the interference if we were putting 30 amperes into our antennas. In New Zealand our working waves are from 140 to 170 meters and we would much prefer to send below 200 meters, but we will look to *QST* to tell us the best wave to use.

In the recent tests with Hawaiian amateurs, both 6TQ and 6CEU were heard here. However, we transmitted on 195

(Concluded on page 47)



HINTS ON BUILDING RECEIVING SETS

By H. F. Mason, Department Editor

THREE is nothing hard about building radio receiving equipment. Anyone who can drive a nail straight can, with the aid of a few tools, the proper parts, and a knowledge of how to proceed, build a piece of receiving apparatus that will be all he desires. The purpose of this article is to give some practical hints on receiver construction and to outline a good method to follow in planning and building. These remarks will not apply to any particular type of receiving set, but are general. The knowledge of how to do a thing is a great part of doing that piece of work well, and the better the amateur builder knows how to go about his work, the better will be the result of his efforts.

It is not necessary to have access to a well equipped machine shop. Much has been done within recent years in the standardization of radio parts and in the marketing of small machine parts, units, panels, etc.; the result of which is to aid the kitchen table mechanic in doing a first class job. It is true that a small machine lathe is a very handy addition to the amateur's workshop but the amateur would usually rather spend his money on a few more tubes or other radio apparatus and, when he has some lathe work to do, take it elsewhere to be done. So then, in this and subsequent constructional articles the assumption is that only the corner of the basement or the kitchen table is available as a workshop and that the number of tools is limited to necessities only.

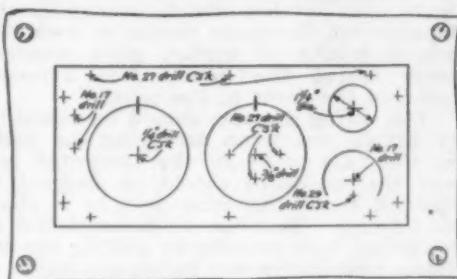
The progressive amateur builder will fortify himself with the latest catalogs of several good radio manufacturers, dealers and mail-order houses and be thoroughly familiar with the parts listed in each of them. He will also be a frequent visitor at the leading radio stores in his town; and will by constant observation add to his knowledge of the constructional details of radio sets and how they are put together.

Planning the Set

The first thing to do, when a piece of apparatus is to be built, is to make a

complete list of the necessary parts, preparatory to obtaining them. It is worthwhile to make this list complete, including every condenser, screw and bracket, for it is very exasperating to have a receiver nearly completed and be anxious to try it out, only to find that some part is missing.

With pencil and paper, draw up some rough sketches of how the finished set is to look. Is the set to be low or high, long or short, etc.? What parts will be mounted inside of the cabinet, if the set is to be in a cabinet? Are the binding posts to be on the front of the panel or at the rear, and how many tubes will



Your template should appear something like this
FIG 1

there be? How many knobs and dials will there be on the front of the panel? All of these questions will be answered in the preliminary sketches. Many of these things will depend on the circuit that is to be employed, so a complete, neatly drawn schematic wiring diagram of the proposed set should also be on hand.

The next step is to begin purchasing the parts for your new set. If you do not feel that you can tell good apparatus from poor apparatus—and every good radio store has both—get a competent friend to go with you and advise you what to buy. Remember, too, that each piece that goes into your set should be both mechanically and electrically as near perfect as possible. This does not mean most expensive, as for instance a porcelain tube socket, which is without doubt the

best electrically, is one of the cheapest. However, it is beyond the scope of the present article to discuss the advantages and disadvantages of various makes of apparatus.

Buy the panel last. You will then have the opportunity to lay out the various pieces of apparatus on a table in the relative position they are to occupy in the finished set and tell just how large the panel should be for the best arrangement. Within the past year manufacturers of panel materials have agreed on a set of standardized sizes of panels which are carried in stock by good radio stores. For his own convenience, then, it is well for the builder to plan his set so it will fit a panel of one of the following standard sizes:

6" x 7"	7" x 18"
7" x 9"	7" x 21"
7" x 12"	7" x 24"
7" x 14"	

In addition to the above sizes there are others that are more or less standard, besides which you can usually obtain panels of any special size on order or can get a large enough piece of the panel material and cut it to the desired size yourself with a hacksaw.

In laying out the parts in the approximate position they are to occupy in the finished set, the main things to work for are simplicity of wiring, good arrangement behind the panel, good arrangement on the front of the panel.

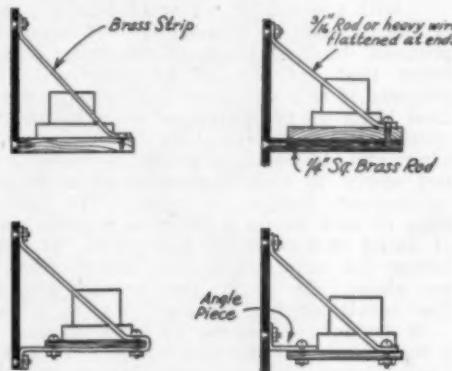
The wiring diagram should be constantly before you when arranging the parts as they are to be in the completed set, and the apparatus should be disposed so that all connecting wires will be as short as possible. This can be accomplished in a vacuum tube receiver by putting the antenna connections and tuning apparatus at one end of the set, with the detector tube next, and then the audio amplifier. This can be contrasted with an improper arrangement where the tuning apparatus is put in the center of a cabinet with the detector tube at one end and the audio amplifier at the other. The apparatus should not be crowded in order to obtain short connecting leads, however. Keep all inductances at least one inch away from the cabinet and panel in all directions and at least two inches from metal objects such as variable condensers, panel shields, audio transformers and such. Likewise, audio transformers should be separated at least a couple of inches and have their cores at right angles to prevent interaction. When choosing the vario-couplers and other inductances for your set, give preference to those wound on cardboard tubes with the minimum number of metal parts near the wires.

At this stage a cabinet can be obtained

for the set. Here is another advantage of choosing a standard size of panel; you can obtain a cabinet that is built to fit your panel. These cabinets can be had from several firms either in knocked down and unfinished form, or completely assembled and finished.

Laying Out the Panel

When you have all of the parts at hand, together with the schematic wiring diagram and your rough sketches you are ready to make a template for drilling the holes in the panel. This template is a sheet of heavy paper, the size of the panel, with the location of every hole marked on it. See Fig. 1. The template can then be placed over the panel and punch



Method Of Securing the Bottom Panel
FIG. 2

marks made through the paper where the holes are to be, after which the template is removed and the holes drilled.

There are reasons why this procedure is best. It is impossible to mark the holes accurately on the front of a panel without putting pencil lines or scratch marks on the panel. Neither of these can be removed from the polished panel very satisfactorily without leaving marks. It is easier to erase pencil lines on a sheet of paper than to remove center-punch marks on the panel if a mistake is made.

The first step upon obtaining a sheet of paper a little larger than the panel will be to draw on it a rectangle the exact size of the front of the panel. Then determine where the shafts of the main pieces of apparatus are to come through the panel. You will have the apparatus at hand, besides your preliminary layout, so this should present no new difficulty. Circles of the same size as the dials should be drawn with a compass in the correct location and they will give an idea how the finished set will appear. Take care to space the apparatus the proper distance inside of the cabinet and arrange it to ac-

commodate the wiring to best advantage. If the parts are too much spread out the set will be large and cumbersome, with much waste space both behind and on the front of the panel. If too close together the parts will interact upon one another, impairing the goodness of the set, not to speak of the trouble you will have when you start wiring the set. Remember, also, to leave room around the tube sockets and above them for inserting the tube.

After the exact position of every important item in the set has been determined, accurately mark the holes for fastening all of these component parts to the panel. Check the small paper templates that some of the makers of the parts supply against the apparatus itself before applying them to your template and marking the holes through with a pin. Extreme care should be taken to mark these holes accurately.

If there are to be binding posts on the panel, locate them far enough from the edge so the set will go in the cabinet. They should not be placed less than one inch apart nor at the extreme bottom of a panel unless you are sure no difficulty will be had in attaching or detaching the wires. Also locate the binding post as near as possible to the part behind the panel to which they connect, rather than run a wire the whole length of the set to accommodate a misplaced binding post. Then mark all the rest of the holes, not forgetting the ones around the edge that are to hold the set in its cabinet. The template is completed by marking the size of each hole in its proper place.

In order to make a good mechanical job of the set, all parts should be fastened to the panel to form a rigid unit. Variable condensers, rheostats, etc., can be secured directly to the panel but tube sockets and amplifying transformers are usually fastened to a separate wooden board or panel of other material which is in turn fastened to the main panel by brass angle pieces or braces made of brass strip. Various methods of fastening this sub-panel to the main panel are shown in Fig. 2.

If the sub-panel is of wood there is hardly any use of making a template for the holes in it, as they can be marked on it directly. If it is of bakelite or other panel material, however, a template for this sub-panel should be made after the same fashion as the main one. Holes for securing the sockets, amplifying transformers, and binding posts will be marked on this template.

Drilling the Panels

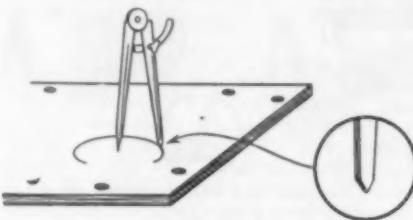
Secure the paper template to the front of the panel with small clamps, or even with a bit of paste, and locate the position of the holes by punching through to the panel with a center punch and light hammer. Then remove the template and go

over all of the holes again, making the punch marks deep enough so the drill will surely take hold.

The next operation is to start drilling the holes, using a small geared hand-drill. Clamp the panel to a flat surface with an old piece of board underneath. Drill the smallest holes first for if you make a mistake you can go back and enlarge the hole to the right size later. Most of the holes will be of such a size as to just pass a machine screw having a 4-36, 6-32 or an 8-32 thread. The drills to use for these holes are No's 31, 27, and 18 respectively. Where the shafts of the various parts come through the panel, make the holes large enough so the shafts will not bind.

To make holes up to $1\frac{1}{4}$ inch in diameter, such as are sometimes used for peep holes in the panel, use a $\frac{3}{4}$ inch drill first; then ream to the correct size with a pipe reamer such as electricians use to smooth out the ends of a piece of conduit, held in an ordinary bit brace. Or you can use a coping saw to cut away most of the material and finally smooth the hole with the large reamer.

If you intend engraving a scale for the filament rheostats, as is often done, do not drill the hole for the rheostat shaft until later. This circle may be engraved by scratching a groove deeply into the panel with an old pair of sturdy dividers sharpened as shown in Fig. 3. This is easily



Engraving the Rheostat scales

FIG 3

done. Then cut in an arrow-head at the right end as shown in Fig. 1. It is also well to engrave a straight groove above each dial to use as a marker. After the engraving is done it should be filled in with some white material. "Monofoil," a greasy, chalky preparation, is made especially for this purpose, though it is not always obtainable. White lead, white ink, or even white toothpaste will accomplish the purpose. If the panel is to be grained, do not fill the engraving until later.

After the drilling and engraving is finished, those holes that are to take flat-headed screws should be countersunk with an ordinary wood countersink held in a bit brace. Take care to do this properly as nothing impairs the looks of a set more

than a poor job of countersinking the holes. Those that come under the dials should be deeply countersunk so there will be no danger of the screw heads interfering.

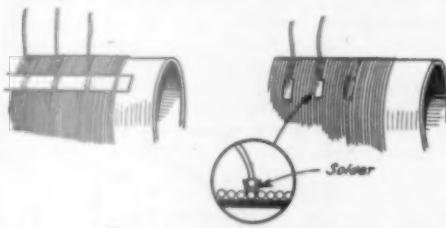
At this stage you may wish to grain the panel. Graining consists simply of sandpapering the "shine" off. Place the panel front up on a smooth surface and if possible clamp it down. Then, with fine sandpaper, or fine steel wool if you can get it, start work. Run the sandpaper exactly parallel with the long edges of the panel *always*, for a cross scratch is hard to remove. When all trace of polish has been removed, clean the panel with a soft cloth, then rub it down well with a little machine oil.

Mounting Apparatus

Start mounting the parts on the panel when all of the above work is done. Use either all nickel plated screws or all brass screws and either flat-headed or round-headed screws throughout. If a machine screw is too long and projects in the rear, cut off the extra portion. Mount the parts so as to simplify the wiring.

Winding the Coils

A few pointers on bringing out taps will not be amiss, for you may have some of this work to do. Figure 4 shows some



Two good ways of tapping coils

FIG 4

good methods. In one case a strip of fish paper is laid under the turns that are tapped as the coil is wound. In the other, a piece of thin copper about $\frac{1}{8}$ inch square, bent U-shape, form a small trough for the solder and connecting wire. Neither of these methods requires cutting the wire on the coil.

Be sure that all of the kinks are taken out of the wire as it is being wound and that the wire is wound just as tightly as you can wind it without breaking the wire. When soldering the taps be sure not to get soldering flux on the coil as it is likely to cause leakage between turns and impair its effectiveness. If you must coat the coils with an insulating varnish to keep them in shape, do not use shellac, but rather colodion, or some similar composition, applied very thin.

Wiring the Set

No matter how careful you have been so far you can completely spoil the looks and operation of your new set by a poor job of wiring. Do not become discouraged, however, for though experience is necessary for a first class job, the beginner by being careful can do the work satisfactorily. All connections should be soldered and the reader should review the article in last month's *QST* before beginning the wiring.

There are two general methods of wiring receivers in use today. The first is to use bare or enamelled wire (the bare wire may be ordinary No. 14 copper or square or round tinned copper wire) running the wires straight and making all corners sharp and square, bus-bar fashion. The other method is to use No. 14 soft copper wire, running the wire in varnished cambric tubing ("spaghetti") but still running the wires straight with right-angled bends as nearly as possible. Of the two methods the beginner will have more success with the latter. One advantage of running the wires in cambric tubing is that there is less danger from accidental shorting of the wires which may cost you several burned out tubes. It takes a good deal of experience to make a real workmanlike job of wiring a set with bare wire if the set be at all complicated.

Begin by wiring the filament circuits, checking off each lead on your wiring diagram as it is put in place. Where a wire runs between several terminals use a continuous piece rather than several smaller pieces. This does away with having to solder several wires to one terminal, which is always rather difficult to do well. Run all leads as short as convenient, consistent with good looks. Always cut the wire to the right length and bend it in the correct manner before soldering it to the first post. If the lead has several bends and is difficult to bend right, experiment with a piece of wire solder as a pattern to get the correct shape of lead; then bend the final wire to the correct shape with the aid of the pattern. A very important point to remember is to keep wires coming from opposite terminals of coils and condensers as far apart as possible. This does not apply to wires coming from the same terminal or to wires in the filament circuits, however.

Testing

After finishing the set and connecting it for test, do not expect it to work perfectly at first. It is not possible to go into detail here on shooting trouble in receivers, but the first thing to do if it does not work is to check the wiring with the diagram and be absolutely sure that it is

correct before you go further. Also be sure that the batteries are correctly connected. Then search for poor or loose connections, especially in the springs in the tube sockets, coil taps, connections to moving parts, etc. If you followed the directions and specifications for the set to the letter you will have found the trouble by this time.

BOOK REVIEW

(Concluded from page 40)

things....Imagine that you are spending a weekend at my home; that we have drawn our chairs before the fire; and that you have asked me, 'Just what is this radio anyway? How did it happen? What makes it work?'—and that, after a long pull at my pipe, I've said, 'Well....it's like this.....' If you wish answers to those questions, read on. I am going to give you a somewhat informal (but, I hope, none the less helpful) introduction to radio."

"Reflex and Radio Frequency"; by M. B. Sleeper; M. B. Sleeper, Inc., New York City. 50¢.

This book is for the man who wishes to build his own receiving set. Detailed worked drawings, photos of the finished sets, wiring diagrams and text, are all given in the well-known clean-cut Sleeper fashion. The drawings carry the signature of Mr. Grimes, deviser of the inverse-duplex circuit. The following sets are described: Grimes 2-tube reflex, one-tube reflex, one-step radio amplifier, 2 stage straight radio and detector, 2-step audio, 4-tube Grimes reflex giving 2 stages radio, detector and 3 steps audio.

INTERNATIONAL AMATEUR RADIO

(Concluded from page 42)

meters and I believe that is why we did not get across as Hawaiian stations undoubtedly had heavy QRM from America. On our next tests we shall be at least ten meters lower, with correspondingly more chances of getting into successful two-way communication with Hawaii. (Why not go down to 100 meters or less, OM, where sigs will be QSA?—Dept. Ed.) On our side Mr. O'Meara, 2AC, used one 50-watter with 4.3 amperes in the antenna and I used two English tubes putting 3 amperes into the antenna. Several others using 5-watt tubes also took part.

During November 6KA was still by far the loudest of your stations. The following are marked "very loud" in my log, although none come near 6KA: 5HT, 6CGW, 6BVG, 6BBC, 6CDG, 6AJD, 6GR, 6PL, 6TS, 6ARB, 6AOS, 6LV (who signs 6LIM), 6BKX, 6BUO, 6BEM, 8RV, 9MC, 9ZT and Canadian 5CN. Some eighth district stations were heard transmitting code words in the transatlantic tests also. 6PL, 8CEI, 9BPM, and 9CCV were heard calling WNP, but so far N.D. here from Mix himself. I am offering a prize of a brand new UV-202 to the first New Zealander who hears him. The filament is busted, of course, but that's mere detail.

(A letter from Mr. W. L. Shiel of Dune-

din, N. Z., reports WNP heard at his stations. See this month's WNP story.—Dept. Ed.)

There is a transmitter in the Philippine Islands which is going to be heard in the U. S. soon. Fred Esler, ex-6ANM, is over there now with a self-rectifying set using two 50-watt tubes. He says it comes in fine all over Manila but he does not know how he gets out yet. Listen for him, fellows. His call is 1ZA and he's dyin' to connect up with some of the U. S. hams. A letter will get to him addressed to Fred Esler, 600 M. H. del Pilar, Manila, P. I.

Franco-British Tests

Some transmission tests between British and French amateurs were held during the latter part of November and the first of December. French amateurs began transmitting on November 26th and continued until December 9th on alternate nights while the British transmitted on the intervening dates. First reports show that out of approximately 104 French amateurs who participated 46 of them succeeded in reaching England. We have no report yet to show how successful the British transmitters were in reaching France. The great majority of those taking part in the tests were using powers of less than ten watts or so and this is probably why more stations did not succeed, as the distances are all under 800 miles.

Italian amateurs are reaching out. M. Guilo Salom, 1MT, of Venice, Italy, exchanged signals with British 2HF on the night of December 9th. The distance between 1MT and 2HF is over 800 miles. This is the first time that an Italian amateur has successfully transmitted over so great a distance. Who will be the first American amateur to hear 1MT?



WHAT'LL WE DO WITH IT?

Strays

The Amateur Builder

The American amateur is criticised for buying too much of his equipment ready-made. Necessity is the mother of invention—and since the necessity for an amateur building his own is nearly past, because complete sets can be purchased on the radio market, the inventive and ingenious spirit of a modern amateur is fast disappearing also, it is declared.

Is this criticism just?

We have started a Department in *QST* known as "The Amateur Builder"; going on the assumption that the majority of the amateurs get more fun out of building a piece of apparatus to their own notions than to buy it ready-made. We are sure that there are many amateurs who avail themselves of standard parts and build their own sets, but we would like to hear from them and get their ideas on what they would most like to see in this new department. A post card to A.R.R.L. Headquarters will do the trick.

6AW is an A.C.C.W. station at Palo Alto, Calif., and never uses voice. All of the cards and letters he has reporting his voice transmissions should have been sent to Cuban 6KW, the broadcasting station of Mr. Frank Jones at Tuinucu, Cuba, who is regularly heard throughout most of the U. S. This is just another reason why broadcasting stations should sign "six K king A able," etc.

If you want to make that detector tube get right down on its hands and knees and go looking for 'em, use a Federal 1850-ohm potentiometer in series with a C battery where your grid leak would ordinarily go.

Here is another way for the "five watt wonders" to compete for the championship. Figure the total cost of your transmitting equipment only and divide the greatest distance you have actually worked by this figure, thus giving your rating in "miles per dollar." 1BEF starts it off by scoring 77 miles per dollar! Who will raise him one?

Asking for Trouble

Just to start something this page is

going to make the claim that 1ER at this moment has the record for number of stations worked transcontinental in 100 minutes. Let's see your records with logs to prove 'em. Huh? Not a bit of it—we'll tell you what 1ER did afterwards—and prove it too.

Dead Spots in the A.R.R.L.

The deadliest spot in this League seems to be the writing hand. Trying to pry information loose from this gang is a shade like pulling teeth and also a bit like a surgical operation.

Here the Tech. Ed. has been frantically appealing to all of you for many months to COME THRU WITH SOME DOPE ON DEAD SPOTS and less than 1/10 of 1% have answered.

What in thunder have all the rest of you been doing since 1907?

Double-Barreled Convention

On April 1 there will be held a most unusual radio convention at the Hotel Muelbach at Kansas City, Missouri.

This convention is held by the short-wave men and by those that have never called CQ. Attendance is strictly confined to those that have never sent with any wavelength above 200 and those that have never called CQ. An oath will be required at the entrance to the two telephone booths which will be used as meeting halls.

Does anyone who can get them officially have access to constructional details of the SE-1420 receiver? There are hundreds of persons who would like to have the details of a really good receiver that covers a wide band of wave lengths, as does this one, and that is selective and sensitive, besides being built as a unit.

Have you seen the nifty little "radio call pins" that look like a miniature fifty-watt tube and have the call letters of the wearer on it? One of these is just the thing to wear alongside of your A.R.R.L. pin. R. C. Ballard, 9FZ, has the information on where to obtain them.

All stations interested in the Intercollegiate Radio League, an organization for
(Continued on page 49)

(Continued from page 48)
the relaying of messages between schools and colleges, are invited to get in touch with R. W. Carlisle, President of the City College Radio Club, 140th and St. Nicholas Terrace, New York City, N. Y.

L. S. Hillegas-Baird, up Milwaukee way, is optimistic. He has his A.R.R.L. membership paid up to 1937!

J. K. Bolles, A.R.R.L. publicity manager, is getting to be quite an amateur. He is now looking for someone who will tell him how he can smuggle radio junk into the house without letting the wife know what is going on.

Show Your Appreciation of the Bureau of Standards

Just to show how the standard waves from WWV are being used we would like to have a postcard from every A.R.R.L. man who has used the service at any time since it was started. If you don't have a station card use one of Uncle Sam's—but let's show the Bustan that we appreciate a good service. SEND THE POSTALS TO THE TECHNICAL EDITOR OF QST, NOT DIRECT TO THE BUREAU.

The Champion Carbon company has lately placed on the market a 22½ volt block B battery in which the terminals are placed at one end, thus allowing the batteries to sit side by side with the shortest possible connections between them. A connecting strip is provided to reach to the next block.

The American Hard Rubber Company owns exclusively the rights to the word "Mahoganite" as applied to radio panels and parts. The unauthorized use of this word by others constitutes an infringement.

The new Klosner rheostats are much above the average in rheostats and are worth your attention.

New officers of the Second District Executive Council recently elected for the 1923-1924 season are:

President—W. J. Howell, 2II
Vice-President—Geo. T. Droste, 2IN
Cor. Secretary—D. H. Doscher, 2BSC
Rec. Secretary—Moe Joffe, 2BYO
Treasurer—Robt. T. Morris, 2BQS

Did you notice that we had to print the index to the February issue in smaller type than usual to get everything on the one page? This is the first time in the history of QST that this has happened. We are growing, aren't we?

A tube transmitter putting ten kilowatts of energy into the antenna has been installed at Ft. Douglas. This makes it the

largest army station, instead of WVR at Atlanta, Ga., the five-kilowatt station mentioned on page 21 of the December, 1923, issue of QST.

The article on page 45 of the February issue was written by Frank Curtin, 7SZ of Spokane. We are sorry that Mr. Curtin's name was misspelled as Curtis.

Here's another way to compensate for the filament voltage dropping when you push the key. Using separate plate and filament transformers, try setting them with the cores end to end. If the direction of winding is correct the stray fields will interleave in such a direction as to raise the filament voltage, or at least prevent it from dropping, when the primary circuit of the plate transformer is closed, or when the load is put on the plate transformer. Of course this stunt will only work with transformers having a good deal of leakage and stray field.

A local undertaker who is a B.C.L. has offered to hold funeral services and bury 3QW free of charge. 3QW is thinking of changing over from spark to C.W. and thus save him the trouble.

Have you a copy of the Radio Communication Laws of the U.S. in your station? Do you know the proper method of calling a station; and do you know what to do upon hearing a distress call? Better send 15¢ (not in stamps) to the Supt. of Documents, Gov't Printing Office, Washington, D. C., and get a copy, OM. It may make the difference between your having a license and not having one some day.

The note on page 29 of the February issue, to the effect that copies of the January issue were available, was an error. Our stock of the January issue is exhausted.

An Inexpensive Filter Choke

2MU has a choke coil in his "brute force" filter that has everything beat for simplicity. He obtained an old $\frac{1}{4}$ kilowatt spark transformer; put four dilapidated L-1500 honeycomb coils on one leg with insulating washers between them and then put the core back together again, leaving a small air gap, about $\frac{1}{4}$ inch. Nothing simpler, is there?

It looks as though the recently conducted transatlantic broadcast tests show our B.C.L. friends to be as good at DX reception as we are. English broadcasting stations were heard in 32 states and 4 Canadian provinces, British Columbia and New Mexico being the farthest away. Three hundred and six different listeners heard stations from across the ocean.

Radio Communications by the Amateurs

The Publishers of QST assume no responsibility for statements made herein by correspondents



Hot Stuff on Remote Control

Augusta, Maine.

Editor, QST:

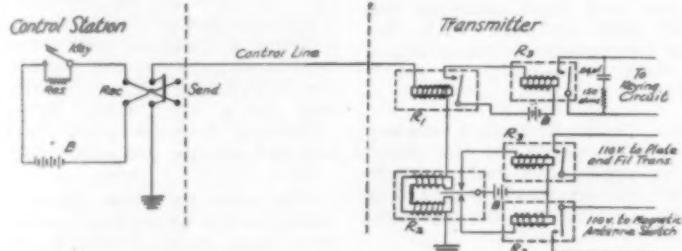
A remote control system should (a) be reasonably simple and practically fool-proof, (b) use the fewest number of wires between the control station and the transmitter, (c) preferably use only standard inexpensive apparatus (ND on difficult-to-construct trick equipment), (d) preferably give the sending operator some information as to how the transmitter is operating, (e) be able to turn on and off the filament and plate current, allow keying of output, and possibly the grounding of the transmitting antenna when not in use.

The suggested circuit incorporated in the accompanying diagram does all of these things.

receiving position and current to transmitter will be cut off at the same time. Because relay R-1 operates on a strong current only and strong current can only pass when the key is down, R-1 will not be influenced by the position of the send-receive switch.

If the 110-volt line to the transmitter is brought through the control station an ammeter and voltmeter can be installed here and they will serve as indicators as to how the transmitter is performing. A second relay, not shown in the diagram, may be connected in series with the actual keying relay to short circuit a filament compensating resistance in the primary circuit of the filament transformer if desired.

Considering the moderate price of the apparatus used in this system, the total cost is small compared to the convenience



To adjust the relays: (a) Disconnect the resistance around the key and, paying no attention to R-2, increase the battery voltage at the control end until R-1 operates with a fairly stiff tension on the armature retractile spring. (b) Cut in the resistance around the key and increase it until R-1 just fails to operate. (c) With the key open, then adjust the polarized relay R-2 until it responds freely in both directions to the pole-changing switch, S.

The operation will now be as follows: Switch S is the send-receive switch. When in the sending position the magnetic antenna switch will be released and will spring to sending position. Primary circuit of both the plate and filament transformers will also be closed. When S is thrown to receiving side, magnetic antenna switch will be energized and return to

obtained in controlling the set at a distance.

—F. C. Patterson.

News From a New Zealander

90 Nursery Road, Linwood,
Christchurch, New Zealand.

Editor, QST:

You Yanks will be the death of me. I've been going to write this for a long time now, but was ashamed of my silly little list of "calls heard" but my pen sure gets away with me tonight. You chaps are banging in tonite, and jamming each other beautifully. It's quite a job to get a complete call. Here's tonite's list. Half an hour's logging. 5EK de 6BOU, 8AZG de 5— de 6BJJ, CA de 9BLY, 1AW de 9AWV, 8— de 6ZBK or 2DK,

and 6AWT, 6GGW. Not sure of this last one. I heard many more thru local fone QRM etc., and fairly bad QRN. I went into the static room to dodge the OW and kids for a while, started up and called CQ but could not raise a single New Zealander. Guess 4AA and a few more are celebrating or something. So I listened a minute and hearing you chaps, I twisted the dials and got to it, but in the end I got sick of QRM and started this letter. My list to date besides those already mentioned includes 6CHR, 6CKP, 6AWT, 6AOS, 6KA, 6AJF, 5GO, 9ZT, 9MT, 9CIP, 6ALK, 9CMK, 9MC. In addition to these few I have had a couple of 4th district stations, but have mislaid the paper I copied them on. I haven't very many calls to my credit, but all these have been logged during the last two months or so on a single valve, a pair of "Amrad basketball variometers", and "Baldies." The valve is a good one, an old marconi VT2. It's been in use about five years now, and has gone quite soft, and is a fine detector. My aerial is a twin cage, forty-five high and 90 feet long. Transmitter is a five watter, in a Hartley circuit. Best DX to date is about 600 miles on fone using loop absorption modulation. Tonight I heard a 9th district ICW fellow going strong, his note being very QRK with the receiver not oscillating. A local fone playing "Yes, We Have No Bananas" QRM-ed his call, so dunno who he was. Peculiar thing, all stations faded together tonight, not right out, but from QSA to QRZ and back again. I noticed this several times and admit I don't know the cause. My loudest "ham" so far is 6KA. He was readable on my one tube with fones a foot from my ears. I copied all his nr 7 to Love, 3BQ, Melbourne, except one word. That was during the last T-P tests. 6KA on this night (I forgot the date,) was copied solid by dozens of amateurs, here. Must have been a freak night for him and yet I did not get more than one other "Yank" that night.

Well, I won't make you waste any more time reading this stuff, so will QRT wishing *QST* (the best in the world) more and more success, and my congrats to those American hams who drop their sigs into this country.

—Len. F. Ball, z3AF.

Let's Reduce QRM

Ann Arbor, Mich.

Editor, *QST*:

The achievements of amateur radio, such as the bridging of the Atlantic and Pacific on the low power we use, reflect most favorably upon us; but when we realize that the very stations that bridge six thousand miles of the Pacific find it hard to bridge the country, the efficiency of our means

of communication does not seem so great.

The greatest obstacle to DX work seems to be the jammed condition of the air around 200 meters, and the failure of most of our receivers to tune much below that. A few minutes listening will convince anyone that much of the 200 meter QRM is unnecessary. One will hear about one third of the stations CQ-ing, many answering CQ's, and the all too small remainder in actual communication with each other. And then his conviction is cinched when he answers a long CQ and listens for his call, only to hear the same station stage another long CQ call.

One cause of the excessive QRM seems to be that for the great majority of the amateurs the ratio of sending to listening is too great. Many CQ's are five minutes long, and the period of listening following them, about one minute. It may be suggested that we overcome this by making the period of listening correspondingly greater.

The fellow who calls a long CQ probably thinks that he is more likely to get an answer to the long call, but in reasoning thus he fails to take into account the fact that someone hearing the first part of his CQ will get disgusted after a minute or so and pass on. The op who, realizing that fact, still draws out his CQ, is as much of a QSL-card fiend as the one I heard this afternoon (call upon request) who, after a long CQ, said, "anyone hearing these sigs pse QSL card." If he is but a QSL card fiend, he might bear in mind the fact that any decent op is not likely to QSL a station with which he is disgusted, even if he does ordinarily QSL stations merely received. So the long, drawn-out call not only jams the air for others, but is not the most desirable for the stations wishing to establish communication or DX.

Some have proposed that we abolish the use of CQ on the grounds that it was not originally intended to get the hard usage it now receives. I think that, regardless of what it was intended for, it has a definite place in amateur radio as the chief means of establishing communication, so I would merely argue (with the wouff-hong, if necessary) that we make all calling short and to the point, for thus we may reduce QRM for others and increase the probability of our accomplishing our immediate purpose. And one must remember that reducing QRM for others encourages them to do likewise, so a person using only short calls is indirectly benefited on that score also.

Another way in which QRM may be reduced is in using more of the wave lengths allotted to us. It has been proven time and time again that transmission on the shorter waves is better than on 200 meters.

Most of us admit that the short waves are the coming thing—but why wait for someone else to do something about it? Each of us should get busy and fix his own receiver for the short waves. Let's pull a few turns from our tuners and shorten up the leads. If you are using variometers connect the rotor and stator in parallel, and after that get some good series condensers for your transmitter.

It's shortening our calling and using shorter waves that will send these QRM babies to oblivion. QSY dwn hr C U Tr.

—David R. Inglis, 8AGF.

Acknowledged Correction

Avalon, Catalina I., California.

Editor, QST:

In the January QST I have noted the letter from F. D. Uriel, Asst. Director, Elgin Observatory. He is quite correct. In the rush of matters at the time I "mixed" my professorial ingredients. It was to Prof. Leuschner, in charge of the University of California's Eclipse Staff at Catalina Island during the eclipse, that time signals were given, on the mountains, by a special wire put up for that purpose by the Pacific Tel. & Tel. Co. I regret that I have accused Mr. Uriel unjustly.

—Lawrence Mott, 6XAD-6ZW.

Co-operation

Statesville, N. C.

Editor, QST:

About a week ago the B.C.L.'s started kicking about my spark. They kept on kicking so I thought I had better investigate. I did and found that they were hearing a leak in the power line. I went around and listened on several sets and found where it was loudest and then notified the head lineman of the power company. He came out and found it just two blocks from the place where the B.C.L. lived who heard it loudest. It was fixed and the listeners are again happy.

—H. P. Woodward, 4DQ, O.R.S.

Bug Sending

Houston, Texas.

Editor, QST:

To date I have heard every district and must say as a general conclusion that three-fourths of the transmitting amateurs using vibroplexes are *pretty punk*. I am a railroad telegrapher working for the Southern Pacific and have been listening and copying good, poor and indifferent sending for the past ten years and as a rule I can consistently say that I have never heard such poor sending as the boys "put out" via radio. One of the great faults is that they take the weights or balls off the bug so that it sounds like the well known "goat on the tin roof,"

it is so fast. Furthermore, a very slowly adjusted bug, with the weights near the end, will move more business in one hour than one with the weights taken off will in an hour and a half. I know because I have seen it done. In addition a slowly adjusted bug will make better characters and will "carry" better than a fast one, the reason being that a fast bug will not enable the sender to make real healthy dashes and still keep in harmony with the very fast dots. At a distance the sending will be very jerky and the receiving operator will have to do a lot of guess work; and that defeats the purpose of either radio or telegraph; whereas a slow but steady sender will be a dozen times easier on the receiving operator and he will be able to make good solid copy for hours at a stretch if necessary.

Furthermore, some of the alleged bug senders make a "6" for the letters "th" by ramming the first dash right into the dots. Then again a "v" will be sent as a "4"; "st" a "v", etc. I could relate the horrible combinations I hear without number.

There is nothing prettier than to hear a real bug sender, but a poor bug sender is worse than the poorest hand sender. The latter is preferred because the hand sender is not a speed demon and you can dope out practically all of it whereas with a poor bug sender and a bug geared up "ninety to nothing" it is a continual guess. But all in all, for radio a hand sender is to be given the chair as generally he will send clearer cut stuff than the man with the bug who does not know how to properly use one.

I feel better now, and hope this criticism will "go home" with some of the boys and that they will slow their "jerked lightnings" down and try their level best to "make something" out of their sending. 73.

—R. K. FitzGibbon, 5ACX (AB).



WWV SCHEDULES

(Concluded from page 36)

can be found in the Bureau of Standards Circular No. 92 which may be obtained on application from the Bureau of Standards, Washington, D. C.

All transmission is by "straight" unmodulated continuous-wave telegraphy. A complete frequency transmission consists of a general call (i.e., "QST de WWV"), a standard frequency dash, and announcements. The call continues for two minutes, including the statement of the *frequency* (not wave length) being used. The standard-frequency dash is broken occasionally by the signature "WWV" and continues for about 4 minutes. The "announcement" is on the same wave length as the test that has just been sent and gives the *exact* frequency of the signal, measured while that signal was being sent. The next frequency is then announced and a 4 minute interval follows while adjustments are made.

Schedule of Frequencies Kilocycles
(Approximate wave lengths in meters in parentheses)

Eastern Std. Time	March 5	March 20
11:00 to 11:05 P.M.	500 (600)	1300 (231)
11:12 to 11:20 P.M.	600 (500)	1400 (214)
11:24 to 11:32 P.M.	700 (428)	1500 (200)
11:36 to 11:44 P.M.	833 (360)	1600 (187)
11:48 to 11:56 P.M.	900 (333)	1700 (176)
12:00 to 12:08 A.M.	1000 (300)	1800 (167)
12:12 to 12:20 A.M.	1200 (250)	1900 (158)
12:24 to 12:32 A.M.	1400 (214)	2000 (150)

Guaranteed Head-Sets

"RED-HEADS" are guaranteed radio phones. You run no risk when you buy them. Money back if, after 7 days' trial, you're not satisfied that they're the best receivers on the market at the price. Why not act right now and get a pair? It'll mean getting the maximum from broadcasting from the day you put them into use.

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RADIO RECEIVERS**

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\$6.50 Per Pair Complete

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"Red-Heads" sent prepaid on receipt of price if you are unable to get them at your dealer's.

THE NEWMAN-STERN COMPANY
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Makes it
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BRISTOL SINGLE CONTROL RADIO RECEIVER

(Non-Regenerative)

Using Grimes Inverse Duplex System

SIMPLICITY OF OPERATION is the outstanding feature of this Receiving Set. One Control Dial includes every adjustment. To tune in turn this Dial. A station once located can always be brought in again at the same setting.

NOT CONFINED TO LOCAL BROADCASTING—this four-tube set has power equal to six. Because the Grimes Inverse Duplex System utilizes the first two tubes for both Radio and Audio Amplification.

FULLY EQUIPPED FOR LOUD SPEAKER—no additional amplification is necessary—the patented Bristol One Stage Power Amplifier is incorporated as the last stage of amplification.

ANTENNA OR LOOP—either may be used to suit conditions.

SOLID MAHOGANY CASE with walnut finish encloses the complete Receiving Set. It is a beautiful piece of furniture fully in keeping with the most luxurious room.

The price—Bristol Single Control Radio Receiver, \$190.00.

Ask for copy of Bulletin AX-3013 describing this set.

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WATERBURY, CONNECTICUT



THIRD DISTRICT GANG!!

FIRST CALL
FOR THE
FIFTH CONVENTION

ALL SET, fellows, for another of those big get-together A.R.R.L. Conventions the Third pulls off every year, with eats and talks and trips and enough sock-chewing to keep a hosiery factory humping. Look at the good things in store for the lucky ham or hamlet that saves up the pennies and comes to Philadelphia; it's going to be the biggest radio hamfest ever staged in the Third District and that's saying a lot!

DATES AND THINGS

(Put them on your calendar in red)

Time: April 24, 25 and 26. (Easter Week—no school).

Place: Hotel Adelphia, 13th & Chestnut Sts., Philadelphia.

Banquet: Friday April 25. Lots of eats and few speeches.

Wouff-Hong Initiation! The final destination of every League member.

ADDITIONAL ATTRACTIONS

A full fledged ham transmitter will be at the hotel. 3DRC (3rd District Radio Convention) will be in operation day and night for the gang to sit in on. (We'll say it will!)

Trips to interesting ham stations, broadcast stations and to Central High School, birthplace of radio and site of Benjamin Franklin's kite experiments.

Technical meetings, contests, exhibits, speeches from WOO, and lots of time to meet other hams and get QSO. BYOW (Bring Your Old Woman).

PLEASE

Make your reservations **early**. It assures you a place and is a big help to the Arrangements Committee. Banquet ticket \$5.00 includes everything but Wouff-Hong Initiation. Just drop a line to:

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EACH Eveready Radio Battery represents thirty years of battery building experience. Each Eveready Battery represents millions of dollars invested in men, methods and machinery. Overseeing Eveready production is the greatest battery laboratory known to science, where every particle of raw material is required to pass Eveready's exacting tests. To insure Eveready serviceability, batches of Eveready Batteries are constantly being set aside for performance tests. And, finally, daily shipments keep dealers supplied with fresh Eveready Batteries, packed full of power.

To be certain of battery satisfaction, insist on Eveready Radio Batteries—they last longer.



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For economical, satisfactory radio, light the filaments of your dry cell tubes with the Eveready Dry Cell Radio "A" Battery. Will unfailingly outlast any other at $\frac{1}{2}$ ampere current. Full instructions for getting this Economical Eighth, on labels and in our booklets. This battery will exceed your expectations in economy and performance.



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The AFRICAN "Drum talk" of TODAY

BOOM! BOOM! BOOM! BOOM!

Thus the drum talk of the natives of Africa broadcasts to a radius of fifty or sixty miles the departure of white men leaving one village for another. To the weird Boom! Boom! of the huge drum, the travelers with their porters commence the perilous journey, knowing that their arrival is expected at the next village.

What a far cry this crude method of sending messages is from our modern, useful, pleasure-giving radio. And how very backward it seems when we consider the rapid strides made in the radio industry in just a few years time as exemplified by the Crosley story.

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Real Merit at moderate prices has brought about this Crosley popularity. Crosley engineers have continually kept abreast and perhaps a little ahead of the rapid advancement that radio has made.

We firmly believe that Crosley Radio Receivers are the best that have ever been offered to the public.

*Insist upon Crosley Radio Apparatus.
For Sale by Good Dealers Everywhere.*



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Formerly

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318 Alfred Street,

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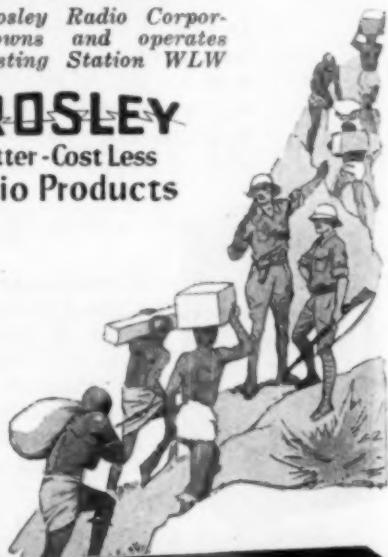
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Crosley Type V (formerly Ace)	\$16.00
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Crosley Model X-J, four tube, incor- porating radio frequency	\$55.00
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We believe that for bringing in distant stations it cannot be equalled.

Cost of necessary accessories from \$40.00 up.

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Here is the Man--Here is the Receiver

The amazing story of continued communication with the MacMillan Expedition, on the Steamer Bowdoin—frozen in somewhere near the North Pole—and with other distant points is here told by Mr. Len Weeks, Radio 9DKB, Minot, N. D.

December 30, 1923.

"I submit the following account of the use of the Ace Type 3B and the Ace Type V radio receivers for DX work, especially with WNP.

"Using the Ace Type 3B or Type V have heard the schooner "Bowdoin" radio WNP a total of seventeen times during November and December. On thirteen of these occasions communication was established. Thirty-four messages totaling several thousand words were received from the Bowdoin, including a 1500 word press dispatch, taken in 3 hours and 30 minutes. Twenty-two messages were sent to MacMillan and members of the crew. The greatest length of time between communication was nine days, of which four were spent away from the station. Signals were unusually readable and often uncomfortably loud on two steps.

"During the month of December Canadian 9BP, Jack Barnsley, has been on a vacation. During this time my station has been the main, but not the only, link between the North Greenland expedition and the United States. Most of the credit for this is due to the fine control of regeneration and ease of adjustment on the Ace sets. Having a



wave length range that completely covers the amateur band, it was easy to quickly shift wave length in order to avoid interference.

"In addition to the above reception, 7AHB in Alaska and 6CEU in Hawaii have been copied several times. Of course stations on both the east and west coast are heard every night. It is nothing unusual to copy stations from every district in a night's work. I have discarded a higher priced three circuit set for I honestly believe that the ACE

sets give greater receiving range both in miles and kilocycles."

January 5, 1924.

"Last night my second operator, Homer Stenserson, a man comparatively inexperienced in amateur work, successfully established communication with WNP, giving him a message and getting an acknowledgment. Many people seem to think that the results are due to expert manipulation. This is not the case, for on several occasions I have had other amateurs listening for WNP while I took a much needed sleep. Nearly always they were able to pick him up and hold him till I got on the job."

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The ACE TYPE V—\$16.00

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A Complete
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NOW READY

A complete revised list of all Telephone Broadcasting Stations showing Call letters, wave lengths, kilocycles, class, schedules, time these schedules are based on and station slogan. Also listed by states in case you miss the call letters.

All American, Canadian, English, French, and Australian Amateur and experimental stations with complete American Radio Relay League Directory. Also Canadian Broadcasting Stations. Complete list of Commercial ship and land Stations of the United States. High Power Land stations of every country in the world.

"How to build the new Regenerative Super Heterodyne," by Lawrence M. Cockaday. Also suggestions for the beginners.

Graphic illustrations of all the latest hookups with construction and operating data shown in such a way that anyone can build their favorite set.

Maps, ICG sheets, blank recording map, distance chart, kilocycle-meter-table, Continental code and other items too numerous to mention.

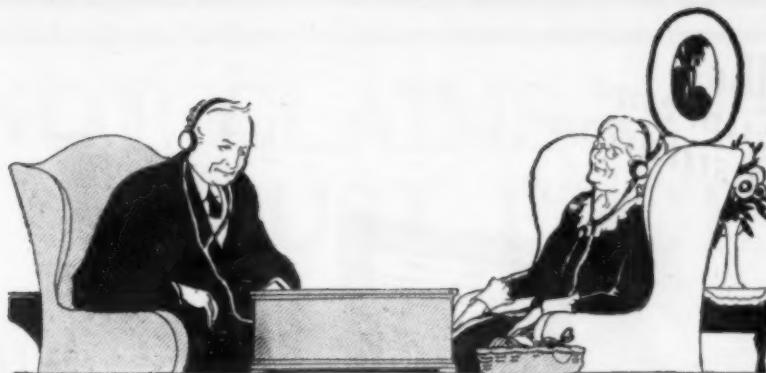
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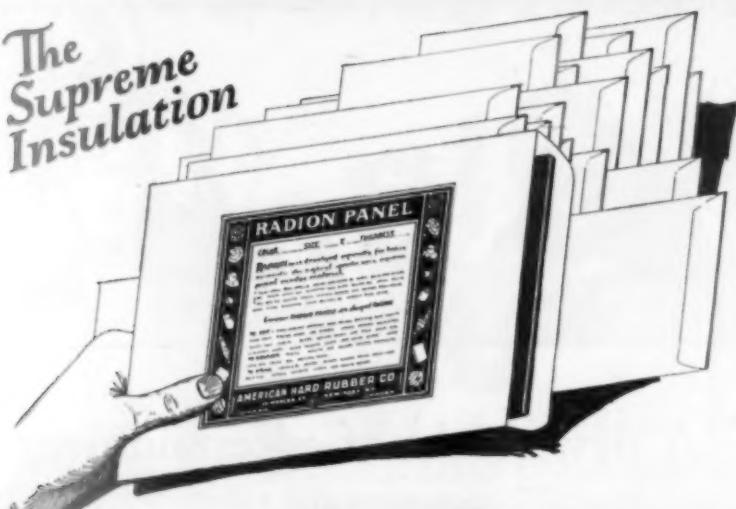
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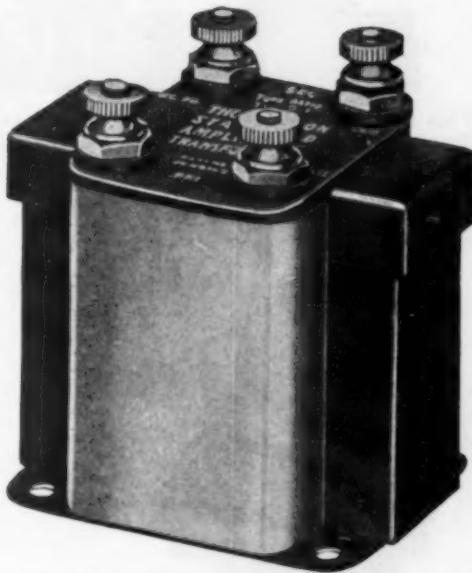
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3½ to 1 RATIO.....\$4.00

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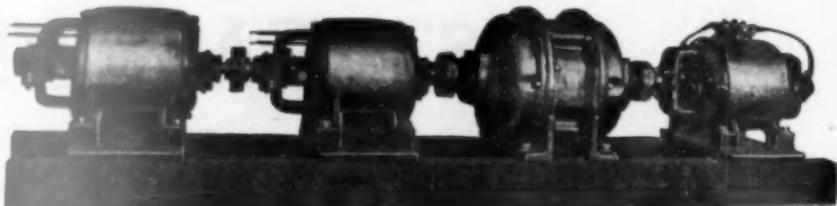
When selecting your apparatus bear in mind the choice of these experts.

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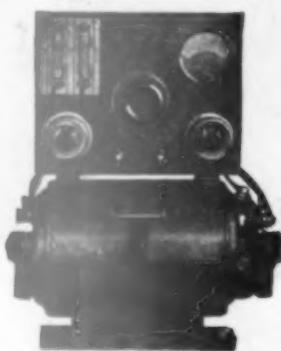
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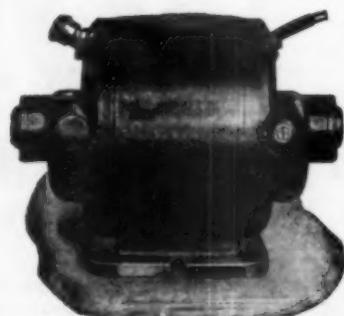


This Special 4 Unit Set made for Wis. Dept. of Markets—the largest Broadcasting Station in existence. A 10 H.P. Motor—two 1000 V., 2000 W. Generators to operate in series, producing 2000V. and 4000 W. and one 12 V. 2000 W. Filament current Generator.

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Other distinguishing features of Stromberg-Carlson Radio Head Sets are—

The receivers are balanced as to volume
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The ear caps cover the ears—excluding outside noises.

The adjustment rod telescopes and fits comfortably on any head.

Send for booklet 1029Q.S.T. which tells more about these superior headsets.

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Gentlemen,

I wish to present a testimonial for your type 247 Condenser, which deserves recognition as being one of the best.

During the recent transatlantic test just completed, twenty-seven European amateur stations were copied at 1ANA. The tuner used was a simple regenerative outfit using one .0005 G. R. Co., type 247 Condenser.

The signals from F8AB, Nice, France were copied every night on a wavelength of 110 meters. Only an efficient condenser would permit of this.

Yours very truly,

R. B. Bourne.

General Radio Condensers are the result of over a decade of engineering research and design.

Send for description in free Radio Bulletin 916-Q



GENERAL RADIO CO.

Manufacturers of
ELECTRICAL AND LABORATORY APPARATUS
Massachusetts Avenue and Windsor Sts.
CAMBRIDGE, MASS.

To Our Readers Who Are Not A.R.R.L. Members

Wouldn't you like to become a member of the American Radio Relay League? We need you in this big organization of radio amateurs, the only national amateur association that does things. From your reading of *QST* you have gained a knowledge of the nature of the League and what it does, and you have read of its purposes as set forth on page 6 of every issue. We would like to have you become a full-fledged member and add your strength to ours in the things we are undertaking for Amateur Radio, and incidentally you will have the membership edition of *QST* delivered at your door each month. A convenient application form is printed below—clip it out and mail it today.

1924

American Radio Relay League,
Hartford, Conn.

Being genuinely interested in Amateur Radio, I hereby apply for membership in the American Radio Relay League, and enclose \$2 in payment for one year's dues. This entitles me to receive *QST* for the same period. Please begin my subscription with the _____ issue. Mail my Certificate of Membership and send *QST* to the following name and address.

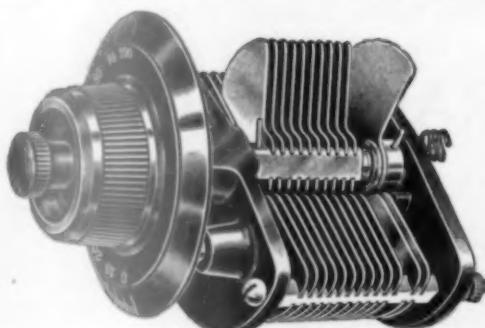
Station call, if any _____

Grade operator's license, if any _____

Radio Clubs of which a member _____

Do you know a friend who is also interested in Amateur Radio, whose name you might give us so we may write to him too about the League? _____

Thanks.



SEXTON CONDENSERS Double Knob Vernier

Most Compact Vernier Condenser Built. Furnished with 3 inch Black Bakelite Dial. Separate Button for Vernier Control. Ball Thrust Bearing Insures Perfect Action.

Also Made in Balanced Types
with Half-Capacity Switch

Write for literature and name of
nearest distributor.

The Hartford Instrument Co.
308 Pearl St., Hartford, Conn.



How many amateurs hear you?

*When the amateurs start matching lists
how many have your call number?*

DO the radio amateurs in far-off cities know you, or are you heard only in the near-by towns? The difference between long range and short range is usually in the quality of the apparatus used.

How to increase your range

THOUSANDS of radio amateurs are using Acme apparatus to increase the efficiency of their sets. One enthusiastic Acme booster writes:—

"I am pleased to inform you that due to the excellent performance of your products, I was able to have signals from my station heard in Orleans, France.

"In my equipment, I am using one of your 600 watt power transformers, unmounted type, to supply plate and filament current; the plate supply, 1000 volts, being rectified by a 48 jar chemical rectifier, and filtered by 8 Mfds. of filter condenser and two of your 500 MA single 1½ henry choke coils. Using Hartley oscillating circuit the antenna current was about 5 Thermo Couple Amperes."

The booklets mentioned in the coupon describe our apparatus in detail. Mail your coupon today and increase your range.

ACME APPARATUS COMPANY, Dept. 36, Cambridge, Mass.

ACME *for* *transmission*

Acme Apparatus Company,
Dept. 36, Cambridge, Mass.
Gentlemen: Kindly send me your latest
catalog of:
 Transmitting Apparatus
 Receiving Apparatus
 Booklet on Amplification without dis-
tortion (Enclose 10¢)

Name
Street
City
State

W

W

New! Double Range Portable VOLTMETER



The voltmeter you need. Locates trouble instantly. Eliminates guessing. Accurately measures filament, plate and grid voltages. Lengthens tube life. A high resistance, double range, portable voltmeter with ranges of $\frac{1}{2}$ and 150 volts.

Write today. If your dealer cannot supply you, we will fill your order direct.

WESTON INSTANT CHANGE PLUG

Takes 2 seconds. Perfect contact. No tools. \$1 everywhere. Step in and get one today.

a dependable voltmeter by
the pioneer instrument
makers of America.

WESTON ELECTRICAL INSTRUMENT CO.,
158 Weston Ave., Newark, N. J.

Electrical
Indicating
Instrument
Authorities
Since 1888

WESTON

STANDARD - The World Over

WE REPAIR THE FOLLOWING

RADIO TUBES

and Guarantee Them

WD-11	\$3.00	DV-6A	\$3.00
WD-12	3.00	UV-199	3.00
UV-200	2.75	C-299	3.00
UV-201	3.00	UV-201A	3.00
C-300	2.75	C-301A	3.00
C-301	3.00	Marconi	3.00
DV-6	3.00	Moorhead	3.00
DV-1	3.00	6 v. Plain Detector	2.75
DV-2	3.00	6 v. Plain Amplifier	3.00

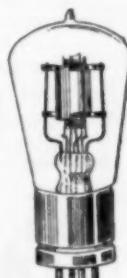
Mail Orders solicited and promptly attended to.
Dealers and Agents write for Special Discount

H. & H. RADIO CO.

P. O. BOX 22-W

CLINTON HILL STA.,

NEWARK, N. J.



A LONG AND SKINNY INSULATOR 18 INCHES BETWEEN WIRE HOLES



Highly vitrified high tension white glazed porcelain, strength 1500 lbs..
In Lots of Six or More
ONE DOLLAR EACH
9DNH SURE FIRE RADIO LABORATORY

Express C.O.D.
MACOMB, ILL.

The CLEAR Loud Speaker!



HOW near the music sounds when it comes through the clear Herald! Just as if you were dining in a famous restaurant, and its orchestra were playing beside you.

That's the effect the Herald always gives. *Absolute clearness.* Because it is free from all blast and blurr. Whether the number be music, lecture or news, the clear Herald is faithful to the performer.

THE Herald, like other good musical instruments, improves with age because of its laminated core, mica diaphragm and permanent magnet. It stands up under power without rattling. The adjustable diaphragm makes it possible to get the most out of a weak set. Height 30 inches. 6-foot cord. Price \$30. Slightly more on Pacific Coast and in Canada. Write for folder and enclose your dealer's name.

HERALD ELECTRIC CO., Inc., 113 Fourth Avenue, New York

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



A VERY POPULAR STYLE OF RADIO TABLE.

DESIGNED ESPECIALLY FOR RECEIVING.

PLENTY OF LEG ROOM.

BATTERY CABINET IS ON RIGHT INSTEAD OF LEFT AS SHOWN IN CUT.

SPECIFICATIONS.

Hardwood, rubbed mahogany or golden oak finish.

Height 31 inches, top 20 x 34 inches.

Drawer with lock, size 4 x 10 x 13 inches.

Battery cabinet, size 17 x 14 x 16 inches.

PRICE

No. 30-R Radio Table \$18.00
Freight prepaid to east of Miss. river.

To Rocky Mt. states freight prepaid, \$20.00

This Table is a very handsome piece of furniture weighing, crated 85 lbs. We make these in our own factory in large quantities and sell direct to you at a small factory profit.

RADIO CABINETS.

Our cabinets are high-grade in every respect and are not to be classed with the cheaply made stained cabinets with which the market is flooded.

Hardwood, hinged tops, tops spleined to prevent warping, rubbed dark red mahogany finish.

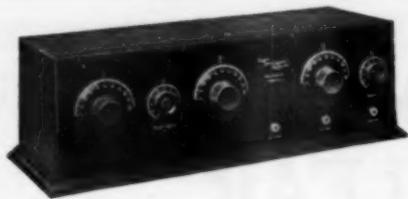
SIZES AND PRICES

7 x 14 x 10 deep	\$3.00
7 x 18 x 10	3.25
7 x 21 x 10	3.50
7 x 24 x 10	3.75
7 x 26 x 10	4.50

Postage prepaid to east of Miss. river.
To Rocky Mt. states add 25 cents each.

CASH MUST ACCOMPANY ALL ORDERS.
Send for free Catalog

THE SOUTHERN TOY CO., Inc.
HICKORY, NORTH CAROLINA



MU-RAD RECEIVERS

STILL FURTHER beyond the accepted bounds of radio reception, this long-range Mu-RAD Receiver, MA-15, has extended the domain of radio entertainment. To the easy operation and high selectivity of the Mu-RAD design, is added a still greater mastery of illimitable spaces together with pure, clear loud speaker volume. All this with only a handy 2 foot loop! The standard Mu-RAD circuit of proven performance—two stages of audio and three stages of radio frequency amplification with detector. Adam Brown, hand-rubbed finish mahogany cabinet with voltmeter for quick reading of "A" and "B" battery conditions.

Guaranteed range with
2 foot loop—1000 miles

Write for Literature

MU-RAD LABORATORIES, INC.
804 FIFTH AVE. ASBURY PARK, NEW JERSEY

How turning this knob gets more stations



BALLANTINE VARIOTRANSFORMER

HERE'S evidence that the tuning dial of a Ballantine Variable R. F. Transformer gives superior results. The light line curves (plotted from careful experiment) show you that fixed transformers do not give satisfactory amplification for many of the important stations. Why? Because the *fixed* windings are out of tune.

Here's an assembly ready to hook into your present set—tube or crystal.

Complete radio frequency amplifier unit with socket \$15.00 and rheostat.
Transformer only for \$9.50 panel or base

At dealers or postpaid



With Ballantine instruments you can accurately tune everything from 200 to 600 meters—by merely turning the knob. This adjusts the windings to the wave length of the station wanted.

Get Stations You've Never Had

Perfect shielding and pig-tail connections assure clear tones. Then, by keeping amplification uniformly high throughout the broadcast range, you get all there is within reach of your set.

Send for This Booklet

"Radio Frequency Amplification with the Ballantine Variotransformer," 25 pages of practical interest. Mailed to Radio experimenters upon request.

BOONTON RUBBER MFG. CO.
Pioneers in Bakelite Moulding

124 Fanny Road, Boonton, N. J.

ADJUST GRID LEAK BEFORE TUNING

Don't wait until you're in the middle of a message to start fussing with your grid leak. Set the DURHAM plunger before you start. Just a touch one way or the other lets oscillation start or stop smoothly—without a "plop." Once set, your DURHAM is good for indefinite service on C.W. or other 'phone work. Before you tune another single time, get a DURHAM Variable Grid Leak.

Choice of Mountings

DURHAMS may be used on grid condensers having clips; or the better way is to run direct from grid to filament, using DURHAM base as shown here.

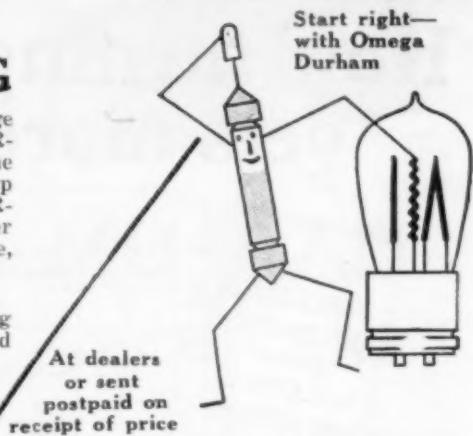
Free folder gives more details.

Get yours from dealer or write

Satisfaction Guaranteed



The handy DURHAM base—30¢



Durham Variables—75c

No. 100 —1,000 ohms to 0.1 megohms
No. 101 0.1 megohms to 5 megohms
No. 101A—5 megohms to 10 megohms

Manufactured by

DURHAM & CO., Inc.

1936 Market St., Philadelphia

Dealers: A. R. R. L. Members are never completely happy unless they're talking "shop". And DURHAM Variables often come in for favorable comment. Try them yourself. They "tune" well on the cash register.

A.R.R.L. Members -- What about your friends?

You must have a friend or two who ought to be members of our A.R.R.L., but aren't. Will you give us their names, so that we may write to them and tell them about the League and bring them in with the rest of us? The A.R.R.L. needs every eligible radio enthusiast within its ranks, and you will be doing your part to help bring this about by recommending some friends to us. Many thanks.

1923

American Radio Relay League,
Hartford, Conn.

I wish to propose

Mr. _____ of _____

Mr. _____ of _____
Street & No. _____ Place _____ State _____

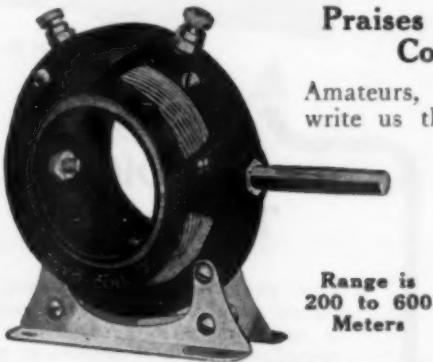
for membership in the A.R.R.L. I believe they would make good members. Please tell them the story.



Follow the Lead of Experts for Assured Results in Radio

You do not find the experienced radio experimenter taking chances with nondescript parts. He has long since learned the lesson of time and temper wasted. He knows the A. B. C. of radio—"Always Buy Coto"—and he will tell you it is a mighty good rule.

Praises from all Quarters Greet the Coto Compact Variometer

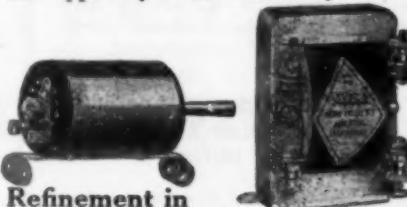


Range is
200 to 600
Meters

Amateurs, Experimenters and Beginners all write us their stories of success with this remarkable new Variometer. Stator coils are honeycomb wound. Rotor is connected with pigtails to avoid "clicky" contacts. Tuning is even over all broadcasting wave lengths. Quality second to none at a popular price. \$5.

Write for Folders

Write us for folder describing all Coto Radio apparatus. Enclose name and address of your dealer and list of parts you need. We will see that he supplies you without delay.



Refinement in Radio and Audio Amplification

is assured by use of Coto Tapped Radio Frequency Amplifying Transformers (Type 5000A) at \$7.50 and Coto Compact Audio Frequency Amplifying Transformers (Type 4000) at \$5. The former covers the entire broadcasting range. Just turn the switch. The latter is 5 to 1 ratio of best shell type, remarkably efficient and true in tone.

Read Carefully Our GUARANTEE

Coto Apparatus is designed and made to give the best possible results in standard radio circuits. Its national reputation for excellence is based on good honest performance under all conditions. So we guarantee each Coto Radio Part to the limit, authorizing all dealers to replace without question for any defect.

COTO-COIL CO.,

87 Willard Ave., Providence, R. I.

Los Angeles, 329 Union League Bldg.
Minneapolis, Geo F. Darling,
705 Plymouth Bldg.
Atlanta, C. P. Atkinson, Atlanta Trust Co. Bldg.

Canada, Perkins Electric Co., Ltd.
Montreal Toronto Winnipeg



Murdock Radio Phones

*are built,
not assembled*

MURDOCK Radio Phones are unsurpassed for acoustical efficiency. For 20 years they have been the choice of research radio engineers and discriminating amateurs—because of their sensitiveness, clarity and volume reproduction. They are made in a single unit, of superior moulded insulation. Each part is fitted by one process into its proper place. They are moulded together—thus assuring firmness, strength, durability and maximum service. And the parts can't get out of adjustment.

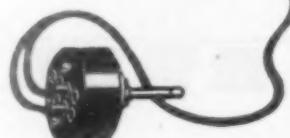
*You can pay more
but you can't get
better value*

Quantity manufacture has standardized the price at what a high grade 'phone should sell for. Over 1,000,000 users have accepted the Murdock standard of quality and price as the best measure of radio phone value. Get a Murdock today and test it out. They are fully guaranteed.

Murdock Multiple Plug Jacks for one to four 'phones.

WM. J. MURDOCK COMPANY
343 Washington Ave., Chelsea, Mass.
Sales Office: Chicago and San Francisco

Standard
Since
1904



PATTERN No. 95

RADIO TEST SET

¶ This radio test set has been designed to meet the demands coming to us from serious experimenters, manufacturers and dealers in radio equipment and supplies, for a complete radio testing outfit.

¶ While the various ranges of readings permit making practically every test necessary in connection with radio receiving sets, it has been particularly designed for the taking of characteristic curves on vacuum tubes, the only extra equipment required being the batteries.

¶ The several instruments, any of which may be used independently, include a 0-1.2 filament ammeter, a 0-6 filament voltmeter, a 0-120 plate voltmeter, a 0-10 plate milliammeter, and a 10-0-10 grid voltmeter.

Complete With Instructions

Price, \$75.00

Send for Circular

ORDER FROM DEALER

JEWELL ELECTRICAL
INSTRUMENT CO.
1650 WALNUT ST.
CHICAGO

CARDWELL CONDENSERS

Code Number	Capacity	Number of Plates	List Prices
141-B	.00025	11	\$4.25
152-B	.00035	17	4.75
123-B	.0005	21	5.00
137-B	.001	41	6.00
*147-B	.00043	43	15.00

*Double spaced, (8000 volt minimum breakdown), Transmitting Condenser.

CARDWELL Audio Transformers

124-B Audio Frequency Transformer, First Stage (ratio approx. 9 to 1) \$5.00

139-B Audio Frequency Transformers, Second Stage (ratio approx. 4.8 to 1) \$5.00

ORDER THRU YOUR LOCAL DEALER

The Allen D. Cardwell Manufacturing Corporation
81 Prospect Street, Brooklyn, N. Y.

IF YOU WANT A TRANSFORMER

"that makes it clear when you're near"

USE A JEFFERSON

"to bring them in just as clear from afar"

USE A JEFFERSON

"that has just the right characteristics to meet your particular requirement—two radio—six audio frequency"

USE A JEFFERSON

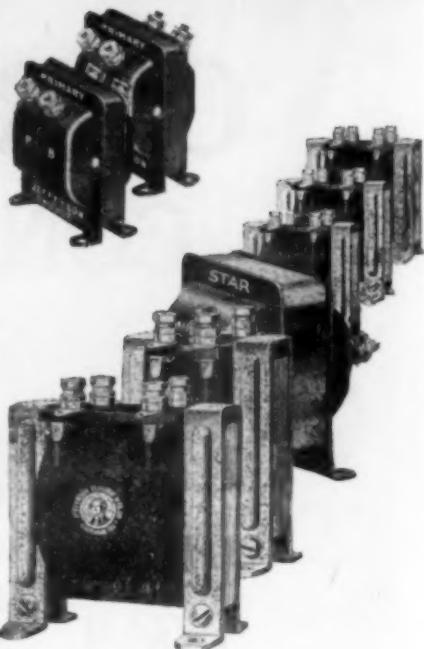
"that is made by a company who have specialized in this field for more than a generation"

USE A JEFFERSON

The Name JEFFERSON is Known Wherever Transformers are used.

You are invited to write our Radio Engineering Department for amplification data. Attractive descriptive literature is also available. This service is gratis.

JEFFERSON ELECTRIC MFG. CO.
425 S. Green Street, Chicago



The New

METALECTRIC SOLDERING IRON

Operates on any electric current with the simplicity and efficiency of a writing instrument.

Accepted as the logical solution to radio soldering problems by leading amateurs and manufacturers.

Ample heat capacity
Handle always
comfortably cool
Renewable tips



NOW
\$3.75

An indestructible all-metal quality instrument with a worth-while guarantee.

If your dealer cannot supply you, order direct or write for descriptive circular. We will ship in exchange for remittance or by P.P. C.O.D.

Post Electric Co., Mfrs. (Section Five) 30 E. 42nd STREET NEW YORK

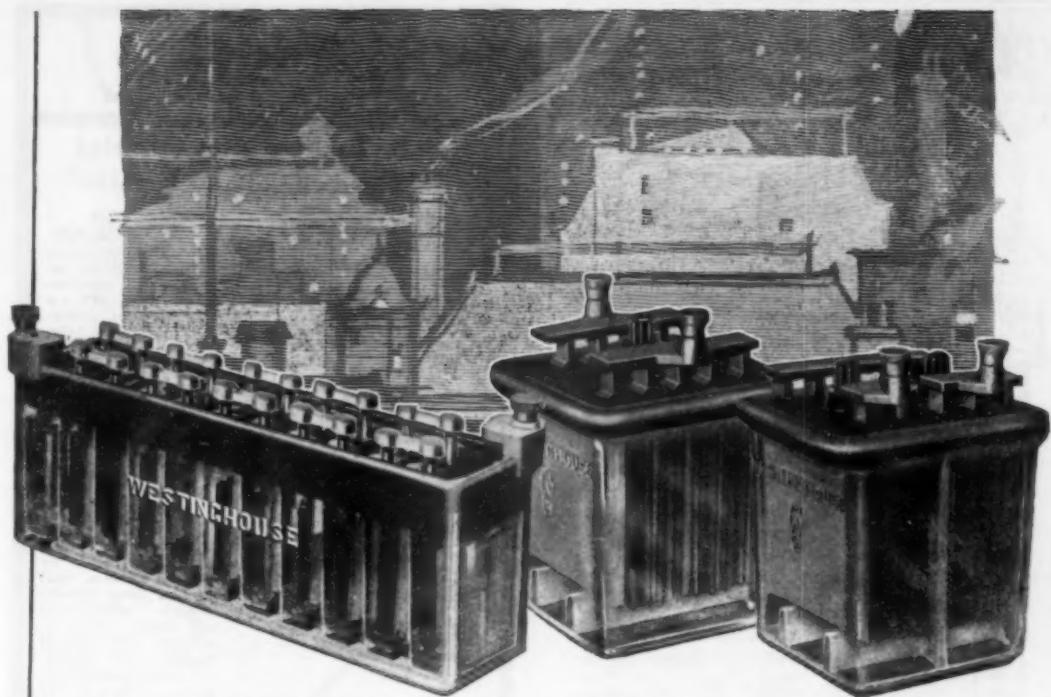


Greater Volume

A Celoron Radio Panel helps you get the best results from your instruments. Its high dielectric strength gives your set greater volume. Celoron, a bakelite product, is approved by the U. S. Navy and Signal Corps, and used by leading radio set manufacturers.

Celoron panels come in nine standard sizes, in black, mahogany or oak. Other sizes cut to order. Ask your dealer.

DIAMOND STATE FIBRE COMPANY
Bridgeport, Pennsylvania
Branches in Principal Cities
Toronto, Canada London, England



NOTHING about a radio set is so absolutely essential to satisfactory receiving as *good batteries*. Sustained voltage, slow, even discharge, ample capacity, utmost quiet, long life—these are important. Don't be satisfied with anything less than Westinghouse Radio Storage Batteries. They are built to meet the most exacting requirements of radio broadcast transmission and reception. And they last! Thoroughly insulated against current leakage. Easily recharged. A size and type for every radio need.

Westinghouse **CRYSTAL CASE** Radio Batteries have one-piece clear glass cases, with glass cell partitions and high glass plate rests (deep sediment spaces). "A" Batteries in 2, 4 and 6 volt sizes. 6-volt size made in rubber-case types too. "B" Batteries in 22-volt units—regular and quadruple capacities. "C" Batteries in 6-volt units.

WESTINGHOUSE UNION BATTERY COMPANY, Swissvale, Pa.

WESTINGHOUSE RADIO “A,” “B” and “C” BATTERIES

Westinghouse Union Battery Co.
Swissvale, Pa.

Send me Westinghouse Radio Battery
Folder A-3-D.



GIVE YOUR SET A BETTER CHANCE
TO MAKE GOOD.

EXPERTS AGREE that here is an achievement destined to supersede other makes of jacks; the—

Mar-Co

Shur-Grip

Jack

Spreading leaf terminals, with ends bent to form small loops, allow use of more rugged wiring, and eliminate the possibility of short circuiting.

Longer and heavier spring leaves. Made of nickelized brass. Best grade of Bakelite insulation. Sterling silver contacts. Extra washers on plug bushing provide ample range of panel adjustment. Any standard plug will fit, although *Mar-Co Radio Plugs are recommended.*

The Staff of our Experimental Laboratory is always at the service of the radio amateur.

*Write for Folders
describing*



Look
for
this
Trade
Mark



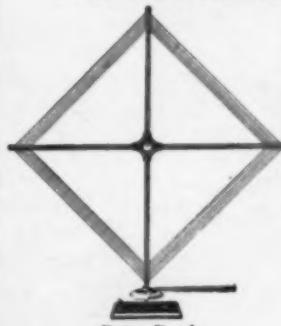
Mar-Co Radio Products
Address: Dept. R-S

MARTIN-COPELAND CO.,
Providence, R. I., U. S. A.

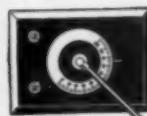
"Mar-Co. Radio Products Insure Success"

DuoSpiral

The Leading Loop Aerial
With New Dial and Handle



Pats. Pend.



Adjustment is made easy by handsome dial and a long handle which eliminates all body capacity effects. The green double silk covered wire is kept always taut by hidden springs. The DUO-SPIRAL loop completely replaces roof antenna and ground practically eliminates static.

24-inch size... \$8.50. 12-inch size... \$7.50

(These prices include new dial and handle)

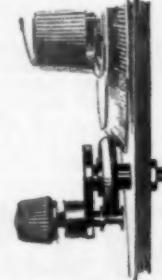
Tiny-Turn

A New and Superior
Vernier Control

TINY TURN makes possible an exactness in tuning never before attained. It has a 30 to 1 gear ratio instead of only 4 or 5 to 1 as in the ordinary vernier. No lost motion! The vernier turns in the same direction as dial. It can be instantly disengaged, leaving dial free. INSTALLED ON ANY SET IN 3 MINUTES. Handsome nickel and black finish. Packed in individual containers. We furnish counter display demonstrating boards.

Price 75 cents

The above products (folders on request) are sold through dealers and jobbers. If your dealer cannot supply you, write us direct.



Pats. Pend.
Side View showing friction drive against dial.

RADIO UNITS INC

1311 First Ave.,
Maywood, Ill.

A Freed-Eisemann KNOCK DOWN NEUTRODyne RECEIVER



Unassembled Model KD-50
Freed-Eisemann Neutrodyne Receiver.

NOW the opportunity is presented to obtain a complete set of parts, recommended by the manufacturer, to work with each other in building your Neutrodyne set. An illustrated 32-page book on how to build the Neutrodyne with full-sized diagrams and templates included.

Complete
With full instructions

\$80

Dealers Write for Name of
Nearest Distributor.



Front View KD-50
Neutrodyne Being Assembled



32-page illustrated
book of instructions
on "How to
Build the Neutro-
dyne" with full
size pictorial wir-
ing diagram and
full size panel and
base board tem-
plates, \$1. At your
Radio Dealers.

Freed-Eisemann Radio Corporation

SPERRY BUILDING, MANHATTAN BRIDGE PLAZA, BROOKLYN, N. Y.

Let HOMMEL'S experience guide you



Get in touch with us to-day, write for the new *HOMMEL encyclopedia*, 246T—profit by HOMMEL'S experience—it is paying hundreds of other dealers,—why not you?

LUDWIG HOMMEL & CO
530-534 FERNANDO ST. *ZONZ* PITTSBURGH, PENNA



A Reduced Price A New Bulletin BUT

The same old reliable Roller-Smith Universal Headset, Type A. 3,000 ohms, list price \$6.00.

It brings in the stuff, local or DX as loud and clear as the chimes.

If your dealer doesn't have them write us. Send for new Bulletin No. AG-20.

ROLLER-SMITH COMPANY
16 Park Place, New York
Offices in principal cities in U.S. and Canada

This organization was one of the pioneer wholesale distributors of radio equipment. They have seen hundreds of retailers come and go,—they know from experience "what and when and how" dealers can best sell radio supplies and enjoy a satisfactory margin of profit.

HOMMEL distributes only recognized nationally advertised apparatus that is guaranteed by the manufacturer,—their dealer discounts are very liberal,—their stocks are always ample to take care of any requirement,—they wholesale exclusively and do not compete with dealers by retailing.

HOMMEL'S Dealer Service Department is maintained for your benefit,—their experience and advice will prove helpful to you in many ways, and this service is cheerfully given any time without charge.

"PUSH —PULL" POWER AMPLIFICATION

—added to your audio frequency amplifier by means of All-American Power Amplifying Transformers, develops—in any good loud speaker—the maximum volume with a roundness richness, depth and purity of tone positively amazing!

All-American "Push-Pull" Transformers lead their field—just as All-American Audio and Radio Frequency Transformers do. The most widely used, most popular transformers in the world, Standard on the better sets. Recommended by all the better dealers.

Special Offer!
Send 4¢ for Power Amplification diagram—circular and book of 22 hook-ups

Rauland Mfg. Co.
Pioneers in the Industry
2650 Cayne St.
CHICAGO

*Audio Frequency
(3:1, 5:1, 10:1)*

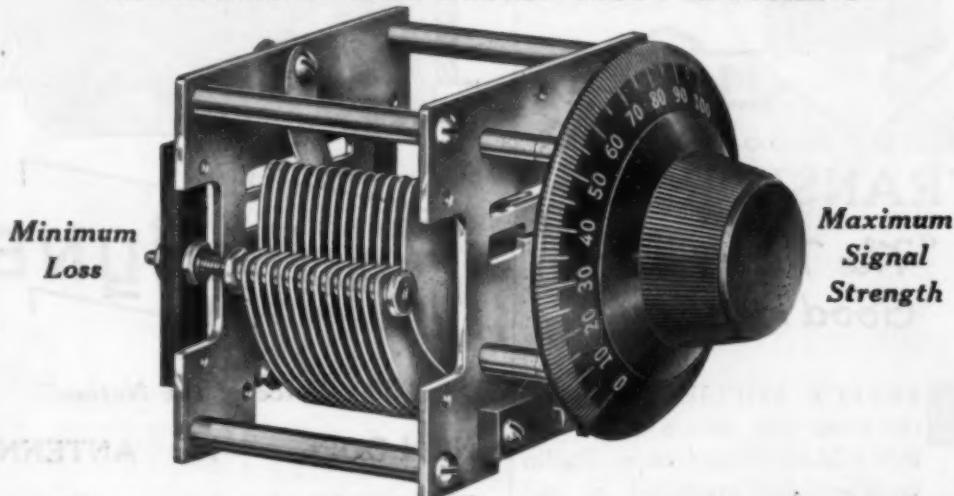


*Power Amplifying
Transformers (input
and output) for "push-
pull" circuits. Each
\$6. The best—no
one pays more.*

ALL-AMERICAN
AMPLIFYING TRANSFORMERS
Largest Selling Transformers in the World

THE NATIONAL PERFECT VERNIER CONDENSER

TYPE DX
TESTS PROVE THIS DESIGN MOST EFFICIENT



We have developed and manufactured condensers for several of the best known receiving sets. The requirements have been exacting but have been met with well designed units of high quality. Over 45,000 of our condensers are in daily use.

In presenting our latest condenser to the readers of this magazine we realize that we are approaching a class of purchasers who are most discriminating. We feel, however, that the unit justifies careful consideration. It has been thoroughly tested in competition with several of the best makes of condensers and the results obtained show that it is equal to the best and far superior to the average. It has an exceptionally low loss and a high ratio of maximum to minimum capacity.

The Vernier Dial is a great aid in micrometric adjustment. It gives a positive reduction in movement with no backlash or lost motion and in combination with the condenser produces a unit whose "touch" is decidedly smooth in operation and attractive to the user.

Mechanically and electrically the type DX condenser is as perfect as scientific design and laboratory skill can commercially produce. It is guaranteed for one year.

PRICES

Type DX 10 Perfect Vernier Condenser (.001 MF)	\$7.00
Type DX 5 Perfect Vernier Condenser (.0005 MF)	6.00
Type DX 3.5 Perfect Vernier Condenser (.00035 MF)	5.75
Type DX 2.5 Perfect Vernier Condenser (.00025 MF)	5.50

THE NATIONAL COMPANY, Inc.
ENGINEERS & MANUFACTURERS
CAMBRIDGE, 39, MASS.

ESTABLISHED IN 1914

If you contemplate purchasing a condenser and your dealer has no Type DX condenser we make for a limited time, the following offer:-

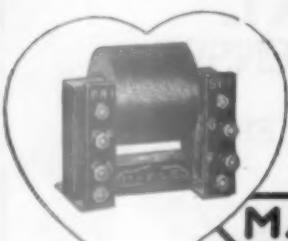
The National Co., Inc., Cambridge, 39, Mass.

.....1924

Gentlemen:-

Find enclosed check M.O. for.....
for.....Type DX Perfect Vernier Con-
denser size..... I am to use it for
five days and if not satisfied, I am to return
it to you carefully packed by Parcels Post in-
sured, and upon receipt of same you are to re-
fund purchase price.

Very truly yours,

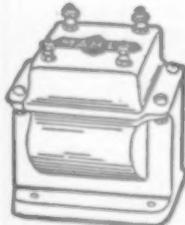


MARLE
Radio & Audio Frequency
TRANSFORMERS
*"The Heart of a
Good Receiver"*

PERFECT AMPLIFICATION is the boon you secure when you buy a *Marle Transformer*. Radio impulses are magnified to the uttermost limit without a sign of distortion. True over the widest range of frequencies. Special folders showing the hookups for standard circuits, sent upon request.

Write for hookups and Illustrated Folder TODAY!

Your Dealer Sells Marle Transformers, or Write to us for the names of the nearest Marle dealers.

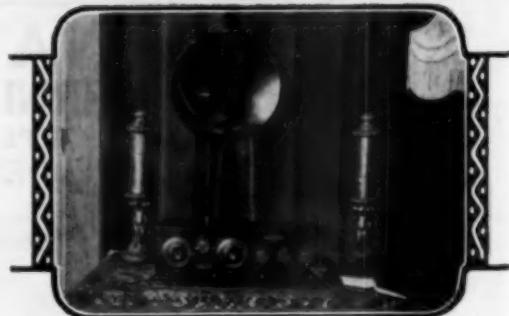


MARLE
Engineering
Company
Orange
New Jersey

Audio F
Type A7
Ratio of
 $3\frac{1}{2}$ to 1



Radio F
Types
R1 and R2



RADIODYNE

"The Voice of the Nation"

NO LOOPS — NO ANTENNA

The RADIODYNE is ready for operation by simply grounding to a water pipe or radiator, and throwing a few feet of wire on the floor. Uses any standard tubes—dry cell or storage battery. Extremely selective. Simple to operate—*only two controls*.

Stations within a radius of 2000 miles can be picked up on the loud speaker; any wavelength from 200 to 700 meters. You can select the best programs on the Radiodyne.

Price \$150.00

For use in apartments, boats, automobiles, railroad trans., etc., the RADIODYNE is enjoyable where other receiving sets would not be practical.

When interference, strays, static, etc., make other types of reception utterly useless the RADIODYNE picks up broadcast programs clear and distinctly.

TO THE A.R.R.L.

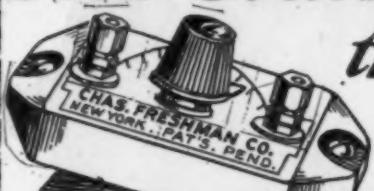
We appreciate your efforts in boosting W.C. sets and are always pleased to furnish full information about them to members who have not yet had the opportunity to operate a Radiodyne. We want every member to know the merits of this efficient outfit.

Just drop us a line and we will see that your inquiry gets prompt attention

Western Coil and Electrical Co.
305 Fifth St., Racine, Wis.



The Stamp of Approval the World Over



FRESHMAN Variable Grid Leak

"The Standard Unit for Every Tube Set"

EVERY tube and every circuit require a different grid leak resistance. The method employed in the Freshman Variable Grid Leak permits you to adjust your circuit to any resistance you wish, from 0 to 10 megohms in an unbroken range of 180 degrees. The Freshman Variable Grid Leak and Condenser combined, takes the place of a grid condenser, leak mounting and grid leak—and, in addition, permits an adjustment to the correct amount of resistance.

Ask your dealer or write for our free diagrams of Neutro-dyne, Tri-Flex, Kaufman and other good circuits.

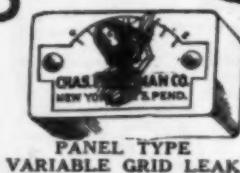
Either Base or Panel Type Complete with .00025 or .0005 MF. Freshman Condenser

Either type without Condenser .75c

The Freshman Variable Grid Leak is the most compact, the most perfect, the most efficient, the most readily adapted to all grid circuits,—and the only one which is entirely sealed and always remains unaffected by any climatic conditions. It is the

ORIGINAL VARIABLE GRID LEAK

At your dealers,
otherwise send pur-
chase price and you
will be supplied with
out further charge.



PANEL TYPE
VARIABLE GRID LEAK

Chas. Freshman Co., Inc.
Radio Condenser Products

106 SEVENTH AVENUE
NEW YORK CITY



"FRESHMAN
SELECTIVE"
MERCURY
VARIABLE
CONDENSER

\$5.00

SIGNAL Radio Products

No two items have so much to do with good reception as the Rheostat and Condenser.

Signal parts are quality parts—yet cost no more.

Look them over before you buy. Your dealer will be glad to show them to you.

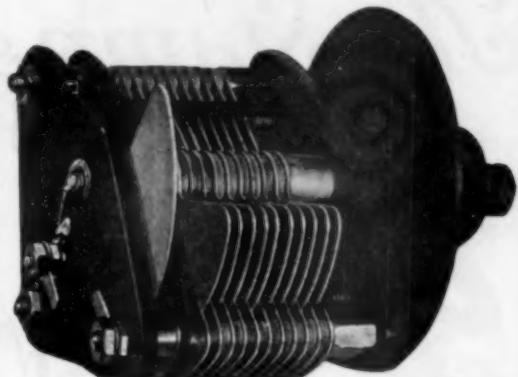
Rheostats

	Vernier	Plain
6 ohms	\$1.30	\$1.00
15 ohms	1.30	1.00
25 ohms	1.30	1.00
40 ohms	1.30	1.00
400 ohms Potentiometer		1.80



Write for illustrated catalog of the Signal Radio Products.

Boston, Chicago, Cleveland, Minneapolis,
St. Louis, San Francisco, Toronto,
Montreal, New York, Pittsburgh,
Philadelphia, Los Angeles
You'll find our local address in your Telephone Directory



Vernier Variable Condensers

R 131—43	plat.	\$4.50
R 132—21	"	4.20
R 133—11	"	3.90

Prices on Plain Condensers on request.

SIGNAL Electric Mfg Co

Factory and General Offices
1915 Broadway,
Menominee, Michigan

Montreal New York, Pittsburgh,
Philadelphia, Los Angeles
You'll find our local address in your Telephone Directory

ARE YOU A 1923 MAN? IF YOU ARE—GET OUT OF THE RUT

Radio has improved with leaps and bounds since last year—to be a 1923 man is to be satisfied with last year's results—Broadcasting and CW will accomplish wonderful results this Fall and Winter and for you to share in these coming successes—both receiving and transmitting—you need a good set, made from the latest and most improved parts.

ROSE RADIO HAS IT !!
(and I don't mean maybe)

ROSE RADIO AND ELECTRICAL SUPPLIES
129 CAMP STREET, NEW ORLEANS, LA.

RADIO PIN—MAP

of United States, Canada and West Indies with indexed Broadcasting booklet guide.

SPOT STATIONS YOU HAVE HEARD WITH COLORED MAP-PINS

Map size, 22x14 in. mounted on map-pin board. Shows by color all broadcasting cities, distance scale, relay and time divisions. Guide gives all call signals, locations, stations, wave lengths, etc. indexed separately by call signals and cities. Price complete 85c; Map pins, 10c per dozen. Any color. At your dealer, or direct.

AMERICAN MAP CO.
MAP MAKERS PUBLISHERS
MAPS OF EVERY DESCRIPTION
7 West 42nd St. Dept. G. New York

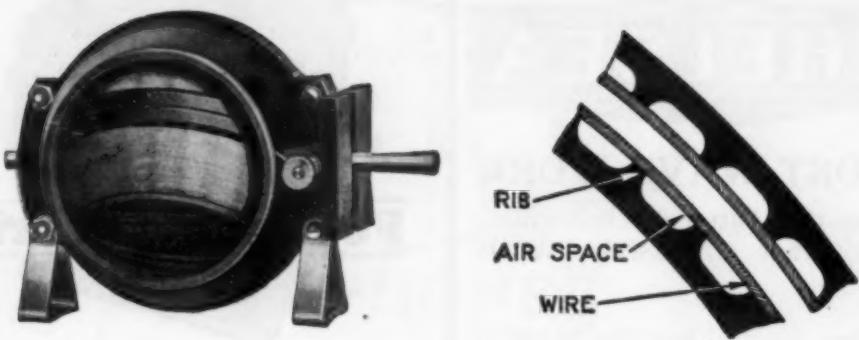
FROST-RADIO Catalog and Instruction Book

THIS new booklet on the care and operation of FROST-FONES and FROST-RADIO is now ready. Contains 36 pages of valuable information on radio apparatus. Your copy mailed free on request.

Address Dept. 11F62
HerbertH. Frost, Inc.,
154 West Lake Street
CHICAGO, ILLINOIS



A post card from you will bring this 40-page catalog.



The Paragon Variometer No. 60

reduces dielectric losses to the minimum. It is the first variometer to combine coils surrounded by air with the mechanical strength necessary in such an instrument. It has no equal in the radio field.

Both stator and rotor forms are of polished black, moulded Condensite, each having 24 narrow raised ribs upon which windings are supported, thus practically surrounding them with air. This design, the result of eight years' experience, meets the rigid electrical requirements of Paragon Receivers and fulfills the high mechanical standards of Paragon parts. Price \$5.00.



Paragon Variocoupler No. 65

The ultimate in Variocouplers. Coils of double-silk covered wire wound on moulded, black Condensite tubes with highly polished finish. Only multiple turn taps are brought out in the primary. Single turn taps and switch for same are unnecessary. Is simple to operate and insures better reception. Price \$3.50.

Write for Illustrated Catalog of Paragon Radio Parts

ADAMS-MORGAN CO., 4 Alvin Avenue, Upper Montclair, N. J.

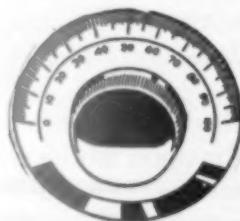
PARAGON
Reg. U. S. Pat. Off.
RADIO PRODUCTS

CHELSEA

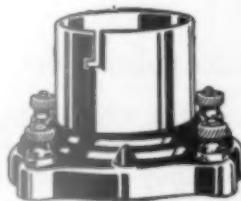
SHORT WAVE WORK

makes that better insulation necessary that CHELSEA PARTS give you.

Chelesa dials of genuine bakelite will not discolor or warp out of shape and always run true.
Sizes $2\frac{3}{8}$, $3\frac{1}{4}$ and 4 inch.



#44 four inch dial \$0.50



#60 Price \$0.75

CHELSEA OFFERS A COMPLETE LINE

Variometer with vernier \$8.00

Variocoupler with Binding Posts \$8.00

Variable condensers with vernier \$4 to \$5, without vernier \$3 to \$4

Amplifying transformer \$4.50
At your dealers or write direct

CHELSEA RADIO COMPANY

175 SPRUCE ST., CHELSEA, MASS.



For All Batteries



The Valley Type ABC Charger

Longer distance and clear signals are the pleasing results which you can be sure of when both the A and B batteries of your radio set are storage batteries. No other source of power for radio equals the storage battery.

The Valley Type ABC Battery Charger is so simple and so easily operated that it makes storage batteries the most convenient and inexpensive source of power for radio. Enjoy radio at its best. Use storage batteries and charge them with the Valley Type ABC Battery Charger.

The Valley Type ABC Battery Charger is made to charge:

2-volt Peanut Tube Batteries
6-volt A Batteries
6 and 12-volt Automobile Batteries
1 to 4 B Batteries

Bakelite panel, glass top. Harmonizes with any receiving set. And as simple as ABC to operate. Plugs in on the light socket like a lamp and connects to battery by means of regular battery clamps.

At all good radio shops.

VALLEY ELECTRIC CO.
3157 S. Kingshighway, St. Louis, Mo.

Valley Battery Charger

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



Imported PHONES

give you a new radio set!

A PAIR of N & K Phones on your old radio set work a complete transformation. They make it sound new and different. Never before have high or low tones, loud or soft tones, come in so clear, so mellow, so natural, so free from distortion.

N & K was designed by one of the world's foremost makers of telephone and other scientific apparatus. It was designed especially for *telephone* reception, whereas most radio phones in use today were originally designed to receive *telegraphic spark signals*. The diaphragm is larger and more sensitive, and is placed at a carefully measured distance from the poles. Even the sound chamber is different.

Last year this head set was submitted to hundreds of American amateur radio stations. 90% of these declared it the best head set they ever used.

Famous for comfort Every user of N & K Phones comments immediately on their comfort and the way they exclude outside sounds. This is due to two things—the extra size of the phones, covering the ear completely, and the leather-covered head bands—which have an additional sanitary value.

You shall be the sole judge

dealers everywhere. They are sold with the understanding that your money will be cheerfully refunded if you do not find that N & K Phones reproduce more naturally, give clearer, mellower tone, and fit more comfortably than any other head set.

Dealers, read this! We authorize you to refund the money on any N & K Phones returned after the above test. We will exchange or replace any that come back to you. Pending the announcement of jobber distributors, we will fill orders direct so that dealers may be prepared for the increasing demand for N & K Phones. N & K comes packed ten to the carton, each carton containing a supply of display matter and literature. Wire or write your order today to department Q8



*N & K Head Set,
Model D, 4000
ohms, Nickel plated brass
casing, leather-covered
head bands,
6 ft. cord. Retail,
\$8.50*

TH. GOLDSCHMIDT CORPORATION, Distributors, 15 WILLIAM STREET, NEW YORK CITY

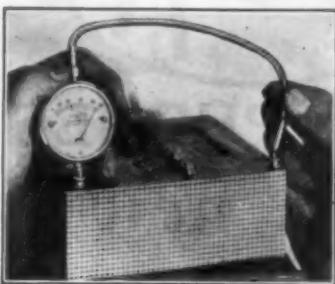
RADIO — Hoyt

A METER FOR EVERY USE ON RECEIVING SETS

POCKET METERS—for testing "B" Batteries. Price \$2.50.

PEEP-HOLE METERS—for testing consumption of your tubes. Price \$3.

ROTARY METERS—for the operator who wants a single dependable in-



strument suitable for all direct current testing on a receiving set. Price \$20.

MISCELLANEOUS METERS—A complete line of instruments—any desired range can be supplied. Portable Meters—volt and ammeters of any desired range. Prices on request.

The HOYT factory is one of the pioneers in the electric industry and one of the very few manufacturers building electrical instruments exclusively.

"HOYT" means the meter will do the work for which it was intended. When you think of a Radio Meter think of HOYT.

Write—BURTON-ROGERS CO.

Sales Department For

HOYT ELECTRICAL INSTRUMENTS

26 Brighton Avenue,

Boston, Mass.

Please send information on HOYT
Name _____
Address _____

KELLOGG VARIOCOUPLERS



The Kellogg variocoupler furnishes efficient coupling, assuring maximum volume and clarity, a wide range of circuit conditions.

The shells are of Bakelite treated to prevent distributed capacity. There are eleven stator and two rotor taps. No sliding contacts; rotors are made with special flexible wire through hollow shaft to binding posts on stator shell. Can be used as a split-variometer. Large bearings warrant smooth operation and long life.

Specify Kellogg and know you have the best.

If your dealer does not handle Kellogg communicate direct with us.

USE—IS THE TEST

KELLOGG SWITCHBOARD & SUPPLY COMPANY
1066 W. ADAMS ST.



The Engineered Switch for Your Radio Panel

Within the dustproof fibre case of the radio switch by Cutler-Hammer, master builders of all control apparatus, is a mechanism that you can safely insert in your most delicate circuit without introducing microphonic noises. Its floating contactor is independent of the button—touching it or jarring the table will not produce noise in your phones. Sold by radio dealers everywhere. Insist on the genuine in the orange and blue box—the C-H trademark is your assurance of satisfaction.

THE CUTLER-HAMMER MFG. CO.
Member Radio Section, Associated Mfrs. of Electrical Supplies
MILWAUKEE, WISCONSIN

RADIO SWITCH

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Electrasote Radio Panels Are 25 to 50% Lower Priced

Yet Electrasote is a quality material, in every respect equal to or better than other high-grade radio-panelling. It is the latest addition to the famous "sote" products which have made internationally famous

THE PANTASOTE COMPANY, Inc.

The laboratory tests of experts and the practical installations of users have proved that Electrasote has an exceedingly low phase difference and a high surface and volume resistivity. Its complete absence of abrasives means, besides, that it easy to work with, cuts clean, and won't dull tools.

Beautifully finished with a high piano polish on one side and a fine satin-grain on the other, Electrasote meets every requirement. Every panel is individually packed in a separate envelope.

Electrasote is now on sale at good radio dealers almost everywhere. Certain desirable territory, however, is still open and offers a most attractive proposition to jobbers and dealers. Write to us for complete information.



M. M. FLERON & SON, INC.

Exclusive Sales Agents for Electrasote Radio Panels

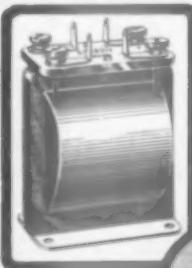
113 North Broad Street

Trenton, New Jersey

IMPROVED IN DESIGN

Reduced in
Price

Samson
HW-A2
AUDIO FREQUENCY
Transformer



Leaping sales per-
mitted a reduction
in price from \$7
to \$5, the same as ordinary trans-
formers.

In six short months the SAMSON won first place among audio frequency transformers. Samson Helical Wound Coils gave to Samson Transformers the highest possible efficiency by reducing the distributed capacity to an absolute minimum, practically eliminating distortion and increasing the amplification 40%.

Now comes a NEW DESIGN, the SAMSON HW-A2 Transformer. Exactly the same in efficiency as the HW-A1 which proved Samson Transformer superiority, the new model occupies 30% less space, has special soldering clips, standard terminal markings, drawn metal case and slotted terminal screws for quicker, more convenient connections.

Samson HW-A2 Audio Frequency Transformers will help your set receive at its best. Get them at dealers; or if yours doesn't carry them, direct from us on receipt of price. Write for Bulletin B28 proving Samson's superiority.

Helical Winding—Samson's Secret

Only Samson Transformers have or can have coils with the wire wound in disc shaped layers. These give to Samson Transformers greater efficiency. One stage of amplification with a Samson Helical Wound Transformer often proves far more satisfactory than two stages of some and better than three stages of other transformers.

SAMSON ELECTRIC CO.
Factory, Canton, Mass.

SALES OFFICES

Boston, New York, Philadelphia, Buffalo, Pittsburgh, Chicago, Cleveland, Detroit, Indianapolis, St. Louis, Atlanta, Minneapolis, San Francisco, Los Angeles, Seattle, Portland, Montreal and Toronto.

BRANSTON RADIO

Branston Univernier Three-Coil
Back-of-Panel Geared Mounting



This is the latest Branston Honeycomb Coil Mounting (R-63). A complete unit. Mounts rigidly on back of panel. Nothing on front of panel but two large closely-graduated dials. Unit has its own terminal block. Spur and bevel gears move coils accurately and give remarkable selectivity. With dial graduations you can "log" stations with precision. Made of genuine Bakelite throughout. Strong and substantial. If your dealer has not yet secured his supply, send check or money order for as many as you need, @ \$8.50 each, or order parcel post C.O.D. Mention your dealer's name, please.

Branston Honeycomb Coil Mountings are made in two and three coil types, both for front and back panel mounting, geared and plain. There is one to meet every requirement. Branston Honeycomb Coils are made in sixteen sizes—Use the two or three coil combinations that give you the wave lengths you desire.

SUPER HETERODYNE Special Announcement

Write for complete information and prices on the following apparatus, which we have especially designed for Super Heterodyne circuits.

No. R-90 Oscillator Coupler. Complete with mounting brackets, bank wound inductances and adjustable coupling coil with locking device.

No. R-91 Intermediate Radio Frequency Transformer. Very sharply tuned and shielded.

No. R-92 Special Transfer Coupler for last Stage of Intermediate Frequency. Very sharply tuned and shielded.

No. R-93 Specially Designed Coupler. For using antenna.

Send 2 cent stamp for New Honeycomb Coil Hookups.



Compiled by experts and includes five good Honeycomb Coil "Hookups" and complete catalog of famous Branston Radio Apparatus. Write today. Give us name of your radio dealer. If he cannot supply you, write.

**Chas. A. Branston,
Inc.**

823 Main St.

BUFFALO, N.Y.

Look for this trademark card in your dealer's window or salesroom.

Manufacturers of Branston Violet Ray High Frequency Generators. In Canada—Chas. A. Branston Ltd., Toronto, Ont.



Dubilier Condensers Standard for Radio Transmitters

Dubilier Condensers, type 577 and 580, are the recognized standard precision equipment for low power tube transmitters, because of their extremely low loss and accurate capacity.

Dubilier Condenser Type 577		Dubilier Condenser Type 580	
Capacity	Voltage	Capacity	Voltage
.00025	1000	.001	5000
.0005	1000	.002	5000
.001	1000	.005	2500
.002	1000	.01	2500
.005	1000	.02	2500
.0075	1000	.0003] These 3 capac-	
.01	1000	.0004] ities combined	5000
		.0005] in 1 condenser	

Complete information will be supplied on request

DUBILIER CONDENSER AND RADIO CORP.

48-50 WEST FOURTH STREET, NEW YORK



Dubilier Ducon
The Standard
Socket Plug



Dubilier
Duratran
Radio-
Frequency
Transformer

DUBILIER DEVICES

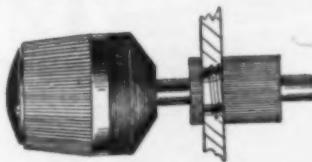


Dubilier
Micadon
The Standard
Fixed
Condenser

FLERON RADIO SPECIALTIES

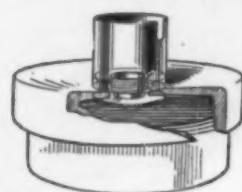


The Porcelain Sockets
Very carefully made. Brass parts nickelized. Black Glaze. Two Sizes. Standard Bulbs and U. V. 199. Each socket in a carton. 35c. each.



The Vernier Adjuster

The best adjuster on the market. Spring holds head away from dial when not in use. With slight adjustment spring can be made to hold head against dial if desired. Patented. 65c.



The Phono Adapter
Fits through the hole of the receiver cap and then slides on the phonograph tone arm. Fits Victor, Columbia, and others. Works perfectly. Only 35c. ea.



The Porcelain Insulators

Lowest power losses in the antenna. Dielectric absorption reduced to minimum because of very low phase difference of Fleron Porcelain. Very tough body. Solid Black Glaze. Seven sizes, 20c. to \$1.00. Each insulator in a separate carton.



The Stand-Off Insulator
Fills the much-needed requirement for a good strong looking and practical stand off insulator. Meets every requirement of the Board of Fire Underwriters. \$1.25 each.

For Sale by all Good Jobbers and Dealers

M. M. FLERON & SON, Inc., 111 N. Broad St., Trenton, N. J.



FANSTEEL **Balkite**

PATENTS
APPLIED FOR
Battery Charger

Noiseless and Indestructible
A new charger for Radio "A" 6 volt batteries. Entirely noiseless. Has no moving parts to adjust or get out of order, and no bulbs to break. Cannot discharge, overcharge or short circuit the battery. Can be used while the radio set is in operation. Simple, positive and unfailing in action. Sent direct on receipt of price if your dealer cannot supply you.

Price \$18 (\$18.50 West)
of Rockies

Dept. Q3 Fansteel Products Co., Inc.
North Chicago, Illinois

HEATH'S Radiant Condensers

Established as Standard

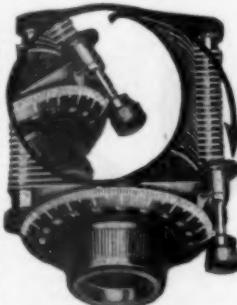
The Electrical Testing Laboratories of New York, have rated Heath Condensers at highest efficiency—"negligible series resistance". The secret is in the Heath process of stamping and tempering plates so that they are PERMANENTLY FLAT.

Unique Vernier
Separate geared adjustment reduces ordinary vernier tuning to infinite fineness.

Write for illustrated booklet and name of nearest Radiant Dealer.

LIST PRICES

Vernier Type
All including 2 $\frac{1}{4}$ " dial and knob. 18 Plate \$5.00; 25 Plate \$5.50; 45 Plate \$6.50. Jobbers and Dealers Write Immediately for Proposition.



HEATH RADIO & ELEC. MFG. CO.
207 First St., Newark, N. J.



THE illustration at left shows the interior construction of the Magnavox electro-dynamic Radio Reproducer, a type representing the greatest advance ever made in radio reproducing equipment.

The diaphragm (shown above) is of special interest, as explained in the body of this advertisement.

MAGNAVOX-

The true Radio Reproducer

THE basis of the operation of a Magnavox Reproducer is its diaphragm, the importance of which can be seen from the fact that it is required to render an almost human service in recreating every tone and quality of instrumental music as well as speech.

This diaphragm (as illustrated above) has been designed and constructed in accordance with entirely new principles. Its shape, size and special character make it capable of responding to the widest range of tones.

But even this highly efficient diaphragm might be handicapped by operating restrictions—every diaphragm must have a vibrating force applied to it, and the inherent ability of any diaphragm will be injured if it is affected by mechanical operation or other foreign influences.

The use of the electro-dynamic principle of operation (found only in Magnavox Reproducers) removes all objectionable influences. This principle, utilizing the famous "movable coil" permits the Magnavox diaphragm to respond in perfect unison to the original tone.

There is a Magnavox for every receiving set: Type R for storage battery sets, and M1 for dry battery sets.

THE MAGNAVOX COMPANY
Oakland, California

New York Office: 370 SEVENTH AVENUE
PERKINS ELECTRIC LIMITED, Canadian Distributors
Toronto, Montreal, Winnipeg

A1-R-\$59.00

This instrument (Magnavox Combination Set) consists of Magnavox electro-dynamic Reproducer combined with a Magnavox Power Amplifier in one unit.

BR

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

PERFORMANCE



Price

\$7.00

2200 OHMS

THE performance of a radio receiving set, like any other mechanical piece is only as good as its weakest part. The Federal Telephone and Telegraph Company manufactures 130 different radio parts, which carry the Federal guarantee of perfection, due to more than 25 years' research by experts in the radio field.

To insure 100% performance specify Federal when purchasing a complete radio or parts.

*All reliable dealers carry
Federal Standard Radio Products*

Federal Telephone and Telegraph Company

Factory: Buffalo, N. Y.

Boston

New York

Bridgeburg, Canada

Philadelphia

Chicago

San Francisco

Pittsburgh

London, England



STANDARD
of
EXCELLENCE
for audio amplification
With all tubes
In all stages

AMERTRAN
TRADE MARK REG U.S. PAT.OFF.

Improve your set with an AmerTran

Its flat-top, distortionless amplification curve assures faithful reproduction of speech and of music over the full musical scale.

In one stage audibility is increased 30 to 40 times in the flat part of the curve, depending on the tube constant—the amplification is approximately 5 times the tube constant. Send for Circular 1005.

Type AF-6: turn ratio 8:1. Price \$7. Ask your Electrical Dealer; or, send carriage charges collect.

American Transformer Co.

Designers and builders of radio
transformers for over 12 years
176 Emmet Street, Newark, N. J.



DeLuxe Contact



Na-alid DeLuxe No. 400

NA-ALD

De Luxe Socket

The laminated phosphor bronze contacts of the Na-alid De Luxe Socket press firmly on both the ends and sides of tube prongs, keeping the surface clean and insuring clear reception.

Moulded of genuine Bakelite this socket expresses the very highest quality in appearance and workmanship.

ALDEN MANUFACTURING CO.
Largest makers of Radio Sockets
and Dials in the world.
Springfield, Mass.
Dept. M 52 Willow St.

NESCO

Complete line Radio Corporation Products, and popular parts for amateurs.

Mail orders given special attention.

Complete consultation at your service for the asking.

In emergency telegraph or call 3ZW,
W. A. Parks.

National Electrical Supply Co.
1330 New York Avenue, Washington, D.C.



A SPECIAL LOW WAVE RECEIVING SET

Wave Lengths from 90 to 380 Meters

Are you having trouble getting short wave signals? The WC-5-SW shown above is the most practical set for low wave specialists. Built by short wave experts the WC-5-SW eliminates the trouble which transmitting amateurs are having with ordinary receiving sets. If you are interested in getting better low wave results it will be to your advantage to investigate the WC-5-SW. Enthusiastic operators from all parts of the country write us praising its efficiency.

WC-5-SW

Built especially for Transmitting Amateurs

The WC-5-SW is a 4-tube set. One stage of tuned Radio-Frequency amplification is employed ahead of the detector to make it supersensitive. Two stages of audio-frequency are used to bring up the signal strength. Uses any type of tubes. Gives perfect control of audibility. Detector rectifies only. Uses antenna compensating condenser. Only two control adjustments. Pure negative biasing on all tubes, thus marked saving on "B" Battery

current. Tuned Radio-Frequency sharpest known and most selective principle ever adopted. Plate potential non-critical. Mono-block tube socket. No grid plate leads on audio amplifiers. Audio amplification absolutely necessary when using low efficiency receiving antenna, i.e., underground or indoor. Mahogany cabinet, piano rub finish. Rabbited-in panel. Split lid cover. The Price is only \$85.00.

Write for complete description and illustrated folder on this practical set for low wave specialists. All transmitting amateurs will be interested in this literature.

OTT RADIO, Inc.

224 Main Street

La Crosse, Wis.



Mounted Charger



100 Volt Panel Type

"I've found KIC-O "B" batteries the most satisfactory."

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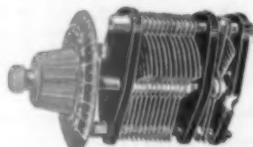
K I C - O Storage "B" Batteries—
long service, low cost

Cells	Volts	Price Plain	With Panels
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24	32	7.25	\$11.75
36	48	9.50	14.00
50	68	12.50	17.00
78	100	17.50	22.50
108	145	23.50	28.50

—and when it comes to selecting condensers, there is no need for deliberation. Of course, the choice is



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Satisfy the most exacting—accurately spaced, permanently adjusted, afford a high maximum to low minimum ratio. There is absolutely no iron used in any bearing or other part of the condenser.

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wire. Made for all types of tubes.
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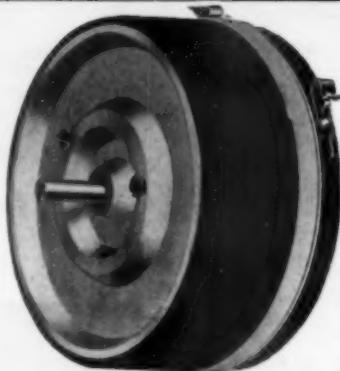
An Easy Way to Cut Out Interference Add a FERBEND WAVE TRAP to Your Set.

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FERBEND
Wave Trap
TRADE MARK
PATENT APPLIED FOR

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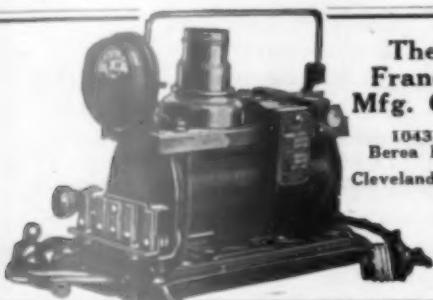


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There are two tiny but sturdy Exide A Batteries designed specially for WD-11 and UV-199 vacuum tubes, and they give fine service with any low-voltage tubes.

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A battery with a pedigree

The Exide A Battery for 6-volt tubes is made in four sizes, of 25, 50, 100 and 150 ampere-hour capacities. These batteries have extra-heavy plates, assuring constant voltage and uniform current over a long period of discharge.

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This 2-volt A Exide Storage Battery
weighs only five pounds



A battery for
6-volt tubes

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An Absolute Guarantee
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Vario-Coupler
list price,
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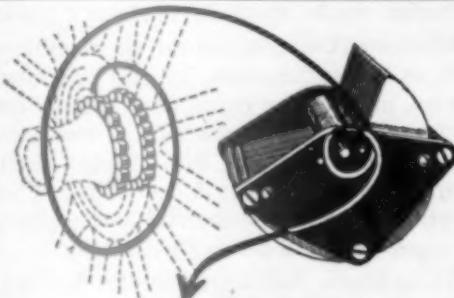
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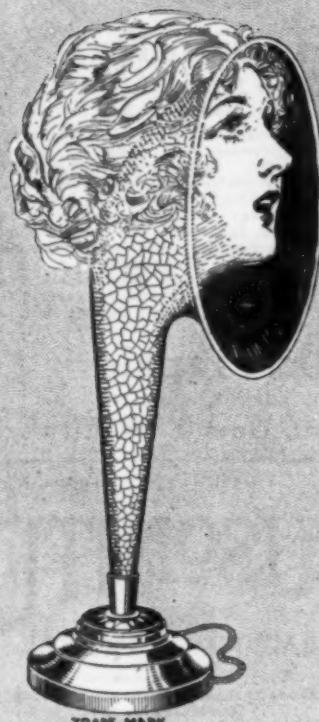
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This new Consrad Packet has been especially compiled by Howard S. Pyle (U. S. Asst. Radio Inspector) and the staff of RADIO NEWS to give the amateur the most valuable data that will enable him to understand the design of his apparatus i.e.: Measurement of Capacity (Substitution method). Measurement of Inductance of a coil or circuit (Two methods). Measurement of Distributed capacity of an inductance. Measurement of Fundamental wavelengths of Antenna (Three methods). Measurement of Wavelength of distant transmitting station. Calibration of a receiving set. Measurement of Effective Antenna capacity. Measurement of Antenna inductance and efficiency capacity. Measurement of Antenna resistance. Proper Filtration of the D. C. Plate supply. Hartley circuit employing full wave self rectification. Navy standard regenerative receiving circuit. Five Watt C. W. transmitter with synchronously rectified A. C. Plate Supply source. The Reinarts tuner. A 15 Watt C. W. Transmitter. A Spark coil low power transmitter. Wavelengths of inductance coils. Table giving oscillation constant and frequency, for Wavelengths between 200 and 20,000 meters. (L. C. in Microhenries and Microfarads). Table giving oscillation constant and frequency, for Wavelengths between 200 and 20,000 meters. (L. C. in Centimeters and Microfarads). Antenna Characteristics.

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\$5 EACH complete with mounting clips ready to mount on your set; no sockets or extra equipment necessary.

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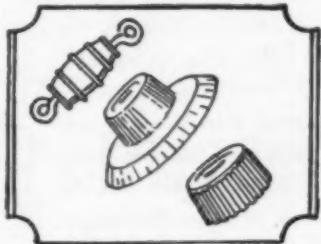
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Made in the beautiful MAHOGANITE or polished black with Dials and Knobs to match.



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SELL FOR HIGHEST OFFER: New Omnidigraph No. 2, with 15 dials. C. L. Somers, Dresden, Tenn.

IF YOU ARE INTERESTED IN ARTISTIC TWO COLOR RADIO PRINT WRITE THE RICHARDSON PRINTING COMPANY, 535 MAPLE AVE., HAMILTON, OHIO, FOR SAMPLES AND PRICES.

NEW STORAGE BATTERIES Six Volts 80 Amperes \$6.50. Generator 500 volts cheap. 824 North Fifth, Phila., Pennsylvania.

REINARTZ TUNER \$12.00, Wavemeter \$10.00, Acme 200 watt C.W. transformer \$15.00, and a quantity of transmitting and receiving apparatus. Send for complete list. T. Porcher, Chestnut Hill, Phila., Penna.

QSL CARDS printed by a 'HAM that knows wot AM'. 60¢ hundred and up. Many different designs and prices. Send for samples. Ray Groebe, Printer, 338 El Mora Ave., Elizabeth, N. J.

SELL OR TRADE—Esco 750 volt, 150 watt two bearing motor-generator in A-1 condition. 110 volt direct current drive. Sell for \$50 or trade for Paragon RA-10, Grebe CR-8 or good standard make receiving or transmitting apparatus. What have you? H. Gilman, 8CZC-8ADQ, 8932 Quincy Ave., Detroit, Mich.

EDGEWISE WOUND Copper Ribbon $\frac{1}{8}$ inch wide 6 inch diameter 15¢ turn, any number turns one piece. Remler Giblin Coils mounted 25-75-100-150-200-300-400-500-600-750-1000 turns, half price. Genuine Silicon Transformer steel, cut to order, 25 cents pound, 10 lb. and over, 4 cubic inches to lb. Postage extra. Geo. Schulz, Calumet, Mich.

WANTED: A Morse Ink Recording Machine. State price and conditions. The Lee A. Bates Co., 274 Main St., Worcester, Mass.

EXTRA—Grebe CR-5 \$42.00, Grebe Rork two step amplifier \$30.00, Cutting and Washington portable receiver using 199 tubes complete \$75.00. Marshall Gerken Suburban receiver \$22.00, Brandes Table Talker \$8.00, Frost phones \$3.25, Sorsinc Tunit \$9.00, Remier 3-coil mounting \$4.00, UV-201 tubes \$4.25, 5 watt tubes \$6.00, Arlington Loose Coupler \$7.00, Airway variometers \$3.00, Kellogg moulded variometer \$5.25, A.C. two-step amplifier \$35.00, Radio Corporation R.F. transformer \$4.25, Rasla R.F. transformers \$4.25, Atwater Kent varicoupler on panel \$9.00, Remier detector panel \$4.00, M.G. detector panel \$4.75, Remier amplifier panel \$4.00, Bremer Tully Universal Tuner \$4.00, Interference Eliminator \$5.00, Fardon Condenser \$7.00, Baldwin phones \$9.00, Morrison phonograph unit \$8.00, Signal Choke Coil \$1.75, Signal Filter \$3.00, Chelsea Loading Inductance \$3.00, Signal Kick Back Preventer \$3.25, Western Electric Horn \$40.00, Cast Aluminum Horn \$6.00, Dunley 23 Plate vernier condenser \$4.25, Grewol crystal detector \$1.50, DeForest Crystal \$1.75, Radiola RS set complete \$70.00, Fada 43 plate vernier with dials \$6.50, Chelesa Condenser .0011 with dial \$4.00, Chelesa condenser .0006 \$2.85, DeForest condenser .0005 \$3.75, Remier Power Rheostat \$1.25, bakelite sockets 65¢, Frost 4-phone plug \$1.50, light-socket aerials \$1.50, Justrite Soldering Iron \$1.75, Chelesa variable grid-leak \$2.00. All new apparatus and subject to prior sale. N. E. RISTEY, 251 West 98th Street, New York City.

500 Volt, 200 Watt, ESCO Motor Generator Set \$45.00. 500 Volt, 100 Watt Motor Generator set \$35.00. 750 Volt, 250 Watt Motor Generator Set \$55.00. All above complete with field rheostats. 500 Volt, 250 Watt, 2750 R.P.M.—Generator only—complete with field rheostat and pulley \$25.00. We also have a number of 1000 Volt Generators and Motor Generator Sets. QUEEN CITY ELECTRIC COMPANY, 1734 West Grand Avenue, Chicago, Ill.

SALE SALE—EDISON STORAGE BATTERIES AND ELEMENTS. TYPE A ELEMENTS 3¢ PER PAIR. TYPE G ELEMENTS 2¢ PER PAIR. 3 POSITIVE & 2 NEGATIVE PLATES TYPE G 4 1/4¢. ALL ELEMENTS ARE DRILLED. EDISON TYPE G-14 375 AMPERE HOUR CELL \$5.75. COST \$48.00 NEW. TYPE A-8 300 AMPERE HOUR CELL \$6.75. TYPE A-12 450 AMPERE HOUR CELL \$9.00. COST \$60.00 NEW. TYPE A-6 6 VOLT 225 AMPERE HOUR BATTERY \$24.50. ALL PRICES F.O.B. PHILA. J. ZIED, 530 CALLOWHILL ST., PHILA., PA.

RUBBER STAMPS—with your call letters in half-inch type, 55¢. Stamps of all kinds made to order. Sample impressions on request. Radio Print Shop, Box 582, Kokomo, Indiana.

1 1000-volt Robins & Myers D.C. Generator with pulley, 500 Watt, with rheostat, cost \$142.00; 1 R. C. Inductance, cost \$11.00; 1 R. C. Rheostat largest size, \$12.00; 1 R. C. Grid leak, U.P. 1718, \$1.65; 8 50 Watt Radiotron tubes, 5 never used, other three good, cost \$240.00; 1 5 Ampere hot wire meter, \$6.00; 4 50 Watt tube sockets Model UT-541, cost \$10.00; 2 Plate reactors UP-415, cost \$11.50; 1 Magnavox transmitter, cost \$24.00; Total \$460.15. Will sell all equipment mentioned for \$236.00. Harry S. Myers, Van, Venango Co., Pa.

AT A BARGAIN—500 cycle 250 watt transmitting set complete or parts, WE tube. HURRY. Leon Faber, 9AMK.

SELL: Western Electric Power Amplifier 10A Complete, New, Hundred Dollars. 3 Radiotrons UV 202, New Four Fifty Each. W. R. Bradley, 48 Jeffrey Avenue, Jamaica, N. Y.

GREBE DIALS TAPERED GRIP \$1.25 Marconi Sockets, a bargain at \$0.40 each. Used filter condensers 1Mfd. good for 700 volts \$0.50 each, 10 of 'em will take that hum out of the old set. S. A. Hendrick, 85 West 181 Street, New York City.

TO INTRODUCE NEW SET will include four radiotrons, loud speaker and batteries for list on bear set Seventy Dollars. Tully Battery Company, Tully, N. Y.

SELL: One Ten watt transmitter less one tube \$45.00. Apparatus is RCA, Acme, and Jewell all in fine condition. Apply to Edwin S. Guilford, Box 224, Farmington, New Jersey.

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SELL: Paragon transmitter, motor-generator, omni-graph, two headsets, det. panel. Description free or trade for Magnavox, Baldys, Det. amplifier, or whatcha got. J. G. Schroeder, Wisner, Nebraska, 9CHS.

MAGNAVOX R3 or M1. Latest nationally advertised reproducers. List \$35. Introductory \$25. The factory sealed carton is your guarantee. Radio Central, Dept. Q, Abilene, Kansas.

SELL: Omnipraph complete with dials \$12. Jim Smith, Weston, Mo.

SELL OR SWAP: 2 new S tubes, 100 watt transformer, want fifty watt; 1 new two stage receiver worth \$100, will sell for \$50. D. G. Goings, Rome, Ga.

TRADE: Good outboard Evinrude motor with fly-wheel magneto, for salt or fresh water, for C.W. Phone set, address C. L. Blakely, North Girard, Pa.

INSULATORS, porcelain, genuine British Commercial 18" long, stand 1500 pounds pull \$1.45 each f.o.b. Canadian 2BN, J. L. Miller, 136 Vendome Ave., NDG, Montreal, Can.

FOR SALE: Ten watt fone, CW, including tubes, transformer, and three meters. Fifty Dollars. F. E. Norwine, Jr., Maplewood, Mo.

FOR SALE: Paragon R.A. 10 and D.A. 2 Detector-Amplifier. Excellent condition, \$80. Glen Franz, 524 Bluff St., Beloit, Wis.

SELL: Three new Western Electric 50 watters \$28.00 each. Telefunken amplifiers 2 volts, 3/10 amperes, fine radio frequency tubes, Western Electric peanut "N" tubes \$5.00, socket \$1.00 extra. New "J" tube \$5.00. 2BYJ.

General Electric transmitting sets for fone, cw, icw Complete with dynanotor, sealed tubes, antenna wire and spares, \$75. 1/4 KW 500 cycle quenched gap transmitters for belt drive New \$75, costing originally \$1650. General Electric Dynamotors with filters for 12 volt battery output 350 volts .143 amperes \$18. For belt drive \$20. 1/4 KW new Crocker-Wheeler 500 cycle-generators with exciters \$25. used \$20. 1/2 KW \$22.50. Large types with motors 1/2 to 2 KW SPECIAL Flame Proof Keys with "Winker" light. "See yourself send" Complete with miniature step down transformer and bulb \$1.50; every up to date station needs one. Western Electric 50 watters \$25. Weston TC Ammeters 0-4 Bakelite constructed inductances \$7.50. Stranded Silicon Bronze wire \$3.00 per 400' roll. Henry Kienzle, 501 East 84 Street, New York.

CHEMICALLY PURE ALUMINUM. Square Foot: 1/8" Eighty Cents, 1/4" Dollar Sixty, 1/2" Sixty Cents. Immediate Shipment. No C.O.D. H. Appleton, 427 Euclid Avenue, Toronto, Canada.

SACRIFICE: Reinartz tuner \$15. Reinartz tuner detector and 2 step in Cabinet \$45.00. Westinghouse Storage-A-60 Amp. \$8.00. F. B. Lutz, 148 Biddle Ave., Wyandotte, Mich.

FOR SALE: Unused Atwater-Kent Radiodyne Receiving Outfit Complete. Information Free. J. C. Weston, South Brownsville, Pa.

NEW W. E. 7A power amplifier and 3 216A tubes \$49.00; \$60.00 R2 Magnavox base \$14.00; 2 W. E. VT 1's \$12.00. R. Breunig, 2252 Roscoe St., Chicago.

SELL: Reinartz with detector 2 step. Heard all dists on loop \$55. 9BDZ.

C.Q.D. SOS: Coto-Coil Radio frequency transformers \$2.50, cost \$5.50; 210 amperes 6 volt Exide battery \$1.75, cost \$6.95. Write for list. William Golden, 680 West End Ave., New York.

\$110.00 Edison Chrome Nickel 6 volt 150 ampere hour storage "A" battery @ \$22.85, same voltage in 100 amperes at \$19.50 each. Guaranteed perfect. Type "g" storage battery elements for that "B" at 1 1/4¢ per pair, large size type "A" @ 3¢ per pair. 3 positives, 2 negatives in type "G" @ 4¢ total. Complete knock-down units consisting of large size plates, special molded glass flat bottom cells (not ordinary test tubes) nickel wire, 200 hole hard rubber separator, chemical electrolyte and simple instruction for assembling, making charger and charging. 100 volt unit \$8.95; 150 volt \$12.90; 200 volt \$16.50. Get my prices and literature with special 30 day

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trial offer. B. Q. Smith, 31 Washington Ave., Danbury, Conn.

VACUUM TUBES FREE!! Write for proposition. 23 plate variable condensers \$4.00 quality, only 95 cents. Send 10 cents for print of best radio hookup known and price list of parts to build set. Address R. R. Stewart, 3023 Boulevard Place, Indianapolis, Indiana.

NEW FADA Neutrodynes Eighty Dollars; Freed Eisenmann five tube Ninety Five Dollars. Tully Battery Co., Tully, N. Y.

SELL: 2 Amrad variometers, 1 Amrad Vario-coupler in separate hardwood cabinets. Fine for experimenters, \$15. 9BDZ.

FOR SALE: 550 volt 125 watt motor generator, double bearing, double commutator 214 bars. Motor drive 110-220 volts A.C., new, with spare armature \$65. Great for phone work. Pre-war DeForest audiotrons, new, \$4.00 each. Western Electric peanut tubes "N" \$4.75 each. Also 50 watt "G" tubes and 250 watt tubes type I, prices on request. Radiotron UV203s at \$22. All tubes are new. Telefunken phones 4000 ohms \$6.00 per pair. Navy SE 143 tuner (LP.500) first \$140 takes it. Half cash with order. Radio 2AGD.

FOR SALE OR EXCHANGE: 3 brand new French fifty watt tubes. Address William Schweitzer, 115 Eastern Parkway, Brooklyn, New York.

FOR SALE: 8CKN's 15 watt transmitter, complete with 3 brand new tubes, filter, transformer, etc. \$80.

WANTED: Western Electric Amplifier Transformer No-III-A. 9RZ.

AMRAD Synchronous motor and high-voltage rectifier disc for same. Twenty-five Dollars. Write if interested. 9DJB, 3808 Wyoming St., Kansas City, Mo.

WANTED: 1500 or 2000 volt motor generator. Sell-Stahl Sinc Rectifier, 3000 volt transformer, Benwood Inductance, honey-comb set. 9CVO.

MASTER RADIO CODE in 15 minutes. Ten word speed 3 hours. Our students made these world records. Previous Failures who tried all known methods have thanked us for License. To hesitate kills speed. To master Code our way kills hesitation; gives speed. Code instructions that instruct only \$2.00. Information free. Dodge Radio Shortcut, Dept. SC, Mamroneck, N. Y.

100 METER coil and complete data for Reinartz Circuit. Postpaid \$1.50. Superior Coil Co., Harwichport, Mass.

HAMS: Get our samples and prices on printed Call Cards, Letterheads, Radiograms and Envelopes. Hinds & Edgerton, 19 S. Wells St., Chicago, Ill.

SELL: 140 VOLT EDISON "B". REMLER DETECTOR PANEL, MURDOCK HORN. CHEAP. VIRGIL HENTHORN, PADEN CITY, WEST VA.

QST MIDWESTERN FANS! Here's a real bargain in a set particularly well suited to your part of the country. A Mu-Rad MA-13 six tube set (three radio, one detector and two audio) listing at \$150 will be sold to first money for only \$100 f.o.b. Hartford. Perfect condition. Address Box M. c/o American Radio Relay League, Htfd., Conn.

FOR SALE: Dandy DeForest 20 watt transmitter, complete. Also a lot of RCA transmitting equipment. WCAJ.

FIRST fifty dollars takes Autoplex with one step in cabinet with battery switch, two new genuine UV201A's, Rico tuned phones. Walbridge, 2248-14th, Troy, N.Y.

FOR SALE. "Send an acknowledgement card". Complete line of samples sent upon request. Wireless Acknowledgement Card Company. 325-6th Avenue, McKeesport, Pennsylvania.

SALE: $\frac{1}{2}$ K.W. Spark Transmitter with cabinet, standard parts \$30.00. Also complete 5 tube receiver unired. W. H. Randel, 14905 Euclid Ave. E. Cleveland, Ohio.

SBRL FOR SALE.

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WANTED: Radiocorp power transformer UP1016 Name cash price. 9AEL.

FOR SALE: Limited number Western Electric 211-A and RCA 203-A fifty watt tubes. A. H. Hardwick, Radio 2 PD, East Highland Avenue, Orange, N.J.

TRADE AMMETER, 8" plate glass AC or DC 0-5 scale. Want flush mounting Jewell radiation ammeter, 5 watt tubes, chokes, and condensers. Radio Shop, Belmond, Iowa.

RUBBER STAMP with large call letters 50¢; Radiogram and Relay Radiogram blanks 25¢ per hundred, Stock Post Card 60¢ hundred. Send us your orders. Carolina Printing & Stamp Co., Wilmington, North Carolina.

FOR SALE—Motor generator just like on cover June QST. 500V 150W 40 fish. Burt Middaugh, 7629 Morgan St., Chicago, Illinois.

FOR SALE: Grebe CR3, 3 circuit long wave tuner and RORD, 100 Watt transmitter with transformers and rectifier. Write for quotations. 9YAK, Yankton, So. Dak.

Every Radio Owner needs our TRANSCONTINENTAL $\frac{1}{2}$ inch PURE COPPER RIBBON AERIAL. Doubles Range and Volume. 75 feet, \$2.75. United Sales Company, Aberdeen, So. Dak.

FOR SALE—Tuska combined Tuner and detector; also swap two stage Magnavox power amplifier, for Paragon Ten watt transmitter. 9CGI.

BARGAINS—For that Storage B battery—Largest size Edison A battery Elements only 4¢ per pair. \$29.50 Edison A-6, 225 amp. hour, sells for only \$15.00 each. Everything in first class condition. We carry a complete line of radio supplies; write us your needs. Triumph Electric Co., Inc., Sheffield, Ala.

WANTED—10, 15, or 20 watt C.W. and fone set. Also large DeForest duotateral coils. 9CGE.

COMPLETE 10 watt transmitter for sale, \$40.00. Thomas Davis, Benson, Minn.

FOR SALE: 20 watt CW and Fone transmitter on panel, complete, less tubes \$85.00. A real DX receiver using Giblin-Remler coils 120-26000 meters and including a Signal Corps VT, one, \$90.00. If interested write for foto, description and records made. 9BSH, 1014 Good Hope St., Cape Girardeau, Mo.

COUPLED INDUCTANCES: For Hartley and Meissner circuits, containing 16 turns of $\frac{1}{4}$ " brass strip on Bakelite supports, 2 coils \$15.00; 3 coils \$20.00; satisfaction guaranteed. 8NX.

BARGAINS: 2 Remler variometers @ \$4.00; Pair Baldwin Fones type E with Federal plug \$8.00; Boston Key \$3.50; Fifteen dial Omnidigraph \$14.00. Satisfaction guaranteed. E. S. Clark, 333 Princeton Place, Pittsburgh, Pa., 6BQS.

FOR SALE: Esco Motor generator and field rheostat, generator 1000 volts, 500 M.A., Motor 110-220-A.C., 60 cycle, 1-phase. This set has only been tested, value \$197.50; first \$150 takes it. G. Atchison, 3712 Roosevelt Ave., San Antonio, Texas.

HAVE SOME NEW Western Electric fifties \$30. new 203's \$19. Would appreciate card anyone hearing 2QH.

RADIO BARGAINS: Aluminum dials 18¢, Home-charger \$9.50; wooden variometers \$2.75, porcelain sockets, \$3.0¢; 30 Ohm rheostats 55¢; and many others. Radio Shop, Belmond, Iowa.

SELL—Magnavox 2 stage amplifier \$50., two Western Electric 216A's \$18., Both \$65. Acme 600 watt 1000-1500 volt transformer with filament connection \$30. E. B. Etchells, Yale, Mich.

FOR SALE: 1 Grebe CR 5, 1 B battery, 1 UV 200, 1 set 3000 Murdock phones, price \$50.00. Have received Massachusetts, New York, Washington, Texas, Chicago, Wisconsin and many other stations. Reason for selling, have another set. Ernest Crabbet, 325-6th Avenue, McKeesport, Pennsylvania.

SALE OR TRADE: Best offer gets all or any part. 2 New Acme 200 Watt CW Transformers, 1 Slightly Used 200 Watt CW Transformer, 3 New Recticon 6

Amp Chargers, 1 DeForest OT3 Radifone slightly used, 1 New R.C.A. 1368-325 Watt C.W. Transformer, 1 Slightly used Electric Specialty 350 V. Radifone Generator, some other apparatus. Bill Paulus, 213 Tomlin, Atlantic City, N. J.

BARGAIN—New Grebe RORN Radio-frequency Amplifier with amplifying tube, \$25. Charles Laper, 116 Williams St., Greenville, Mich.

FOR SALE: Paragon RA-10, DA-2 \$90; 10-R \$25; Used only two months. V. R. Blauch, Leechburg, Penna.

FOR SALE—One half k.w. Acme and 1 k.w. Thordarson transformers, one Thordarson oil condenser, one Benwood quenched gap without motor, one Racine motor with sixteen tooth rotor, oscillation transformer, Murdock aerial switch, Acme anti-light blinker, Roller Smith 0-30 d.c. voltmeter—first money order for thirty five dollars takes all. Sell separate if desired. R. M. Nelson, 58 Penn Ave., Binghamton, N. Y.

5 WATT CW: \$25, brand new tube, 9ELT, Box 8, Whitewater, Kans.

POSITION WANTED: RADIO ENGINEER, now in middle west, desires connection with well established manufacturer in the east. Twelve years radio experience with five years in designing and development work, college education, licensed commercial operator, eligible rating as Radio Inspector civil service, and owning over \$1000 worth of personal laboratory equipment. Technical work with opportunities for advancement more important than salary. Satisfactory references. Available at once. Box E—QST.

FOR SALE: 150 Watt phone set mounted on panel 24x30, Formica panel, 3 meters, 1000 Volt motor generator, 3-50 Watt tubes. M. C. Haigh, 1109 Pleasant View Drive, Des Moines, Iowa.

VIBROPLEX—almost new \$15. 8BOB.

WANTED: 2 and 3 KW non-synchronized transmitters complete, 220 volts, 60 cycle primary; and five condensers .01-10,000 volts. Box A, c/o QST.

SELL: Radiocorp power transformer UP1368. Perfect condition. First Money Order \$14.00. 9AEL.

WANTED: OMNIGRAPH. New 22, A-1 condition. Give full particulars. V. M. Chaberd, 362 Custer Ave., Youngstown, Ohio.

TELEFUNKEN TRANSMITTING TUBES, genuine, guaranteed 30 Watt \$15.00; Filament 2 amperes, 6 volts, Plate 750 volts. Genuine new R.C.A. Model UC1820 "Faradon".0005 variable condensers \$3.50. New genuine u. v. 199 s \$3.75. Arthur Beyer, 106 Morningside Drive, New York City.

FOR SALE: ESCO M.G. FIVE HUNDRED VOLT 2 AMP. TRANSFORMERS; RADIO CORP THIRTEEN SIXTY EIGHT THORDARSON SIXTY WATT FLIXI-TOY AND GENERAL RADIO MODULATION, FOUR RADIO CORP SOCKETS AND TWO GOOD USED FIVE WATTERS. FIRST REASONABLE OFFER ACCEPTED. RADIO SMITH, GRAYVILLE, ILL.

Complete three coil outfit with one step, mounted on panel. Sixty dollar value, thirty takes it. Also batteries, tubes, phones. Forest Otis, Langford, South Dakota.

BIG BARGAIN: 100 Edison A batteries. Same type as used on shipboard auxiliary transmitters. Guaranteed in first class shape. Price \$1100, make offer. W. H. Lewis, Jr., 226 Upland Road, Cambridge, Mass.

MAKE \$120 WEEKLY IN SPARE TIME. Sell what the public wants—long distance radio receiving sets. Two sales weekly pays \$120 profit. No big investment, no canvassing. Sharpe of Colorado made \$955 in one month. Representatives wanted at once. This plan is sweeping the country—write today before your county is gone. OZARKA, 853 Washington Blvd., Chicago.

WHILE THEY LAST: A few 50 watt power transformers left, \$7.00. For 5 watt tubes. 375 volts each side of center tap. Filament winding 10 volts with center tap. Send money order. If not satisfactory, may return within ten days and receive money back. Fair enough! C. C. Endly, 22 Sturges Ave., Mansfield, Ohio.

FOR SALE—Quantity U. S. Navy type CN 113 short wave radio receivers good condition \$15 each; limited number new ones \$20 each. Also limited number long wave type CN 240 receivers, good condition \$30 each. Receivers may be returned if unsatisfactory. Send money with order to **RADIO MATERIALS CORP.**, 949 Broadway, New York City.

FOR SALE: 2" Spark Coil \$8.00. Like new. 9TC.

FOR SALE: 50 watt transmitter. Write 8CP.

FOR SALE—Grebe CR5, \$45. Reinartz in mahogany cabinet, a bear for distance, \$20. 5 WD-11 tubes, \$5.25. 2 1714 Radio Frequency transformers \$3.50. 1 New Type Cardwell 43-plate Condenser \$4. 1 Boston Marble Base key \$3.50. All of the above are new and will be shipped postpaid. Edgar M. Knepper, 317 So. 5th St., Columbia, Mo.

BARGAIN: 9EGH's 20 watt C.W. and fone transmitter. R.C.A. power transformer and 500 V. M.G. DX 2,100 ml. Write.

8RP's Ten Watt Transmitter For Sale. For particulars write Radio 8RP.

FOR SALE: New DeForest Type D-6 Receives all wave lengths, includes 2-25 turn, 2-35, one each 50, 75, 100, 150 DeForest DL Coils, 1 Remler Giblin 35, 2-50 all mounted. First Money Order for 89.00 takes all delivered prepaid anywhere, need the money. M. M. Michaelis, 1757 Lunt Ave., Chicago, Ill.

SELL 9AVP; UP1016 R.C.A. 750 watt Power transformer like new \$23.00. 2 vibroplexes @ \$4.00. 1 KW Acme, spark set complete 1 KW Acme in oil 80 plate condenser 8"x10"x1/4" also in oil. Heavy copper on bakelite O.T. High speed non-sink gap power rheo and switches. \$25.00 Benwood Sink motor 1/2 H.P. Like new \$18.00. 1/2 H.P. Globe heavy duty 110 volt 60 cycle motor and starting switch and 300 volt 100 watt D.C. Generator both \$20.00. 1 KW Marconi (United Wireless) "coffin" transformer 110 volt 60 cycle primary 30,000 volt secondary \$20.00. Ship anything C.O.D. Willard McCulla, Waukegan, Ill.

CALLS HEARD POSTAL CARS (for DX reports). Send \$1.00 with your name, address and call letters for 100 (or \$1.75 for 250) printed report postal cards with large red call letters. Complete form for description of your station, etc. State if member of A.R.R.L. Cards also printed to order. Letterheads—100 and 100 envelopes printed on fine bond paper, special radio size, \$1.75. Samples on request. Printed by 9AVO (member A.R.R.L.) Radio Print Shop, Box 582, Kokomo, Ind.

SELL: Grebe RORN, forty dollars; CR3 and RORD Amplifier, hundred dollars; R3 Magnavox, twenty dollars. A. W. Hynds, Seward, N. Y.

SALE: 1/2 KW 500 cycle alternators \$75; 1/4 KW 500 and 900 cycle alternators \$25; 25000 volt Dubilier \$11; Exide 8V 180 AH storage bats \$25; Advance sink rectifier \$35; Paragon with detector and 3 step to match \$75; Western Electric 50 watters \$28; 6 N tubes \$4; Colt Army .45 cal. automatic \$30; UV203s \$20; 150 or 300 AC voltmeters \$20; 1 HP 60 cycle motors \$60; 1000V generator. [Edward Page, Baldwinsville, N. Y.]

NEW TUNER, Detector and two step \$35.00. R-2 Magnavox \$30.00. One tube set \$20.00. Chesaning Elec. Co., Chesaning, Mich.

SWOP—500 volt 125 watt generator for battery charging generator. CW inductance \$5.00. Marion Graham, Angola, Indiana.

BARGAIN: Will sacrifice my five brand new UV199 tubes. Absolutely perfect. \$3.50 each. Need cash. R. Riedelbach, 1806 Locust Street, Milwaukee, Wis.

SELL: Radio Corporation 375 watt transformer, \$12.50; Grebe CR3A, \$15; Grebe CR2, \$30. Write 2WZ.

9DDJ SELLING OUT. Grebe 2 stage amplifier with tubes \$45.00. 50-watt transmitter, with meters, tube, keys, microphone, etc., complete \$100.00. DX CW—WNP, fone—1400 miles. J. M. Cook, Langford, So. Dak.

SELL: Radio apparatus used and new. Write Albert Krug, Gardner, Ill.

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FOR SALE: Two UV-217 Kenetrons, UP-1016 Power transformer, Acme double choke, six UP-1719 grid leaks, two PR-535 Rheostats, two UV-202 (new) UV-216 (new), two UC-488 condensers. Write, they're cheap. Arthur Walser, Chesaning, Mich.

LOOK: 1 R.C.A. Power Transformer model U.P. 1368 for \$19.50. Has both filament and plate windings. 1 R.C.A. Magnetic Modulator model U.T. 1643 \$6.00. 1 75 watt Acme filament transformer giving either 8 or 10 volts, \$8.00. 1 Jewell thermo-couple ammeter 0-3 \$8.00. 1 Jewell 0-15 A.C. Volt Meter \$5.75. 1 AMRAD single tube REFLEX receiver cost \$40.00 for \$22.50. All the above are practically new and guaranteed to be in first class condition. Terms C.O.D. Elmer Scharbach, Hobart, Ind.

BARGAINS: Western Electric VT2, \$6.50. Genuine Telefunken tubes, \$3.75, fine for Radio Frequency. Acme and Rasla Radio Frequency Transformer, \$2.50. Three Tube Cockaday 4 circuit tuner in cabinet \$2.50. Four tube Reflex 3 R.F. and 2 A.F. with fine loop, \$35. 4 tube R.F. set in cabinet with loop, \$35. Power Speaker Magnavox LS2, \$45. 1/3 Cash with order. All letters answered. S. W. Mayer, Beechmont, New Rochelle, N. Y.

R.C.A. POWER TRANSFORMER U.P. 1368, \$15.00. Large transmitter inductance with grid coil \$3.00. What have you to trade? F. O. Reine, Bruleton, Minn.

NAVY CW-936 transmitter-receiver with two dynamos, power switchboard and filter, two microphones, extension box, control button, antenna switch and spare parts box. Only slightly used and in fine working condition. \$195. Write: John Reid, 126-A Division St., Amsterdam, N. Y.

FOR SALE: Grebe CR3, good condition. Forty Bucks. James Marx, 932 North Fifth St., Reading, Pa.

NAVY TYPE CW 936 transmitter and receiver complete. Includes receiving and transmitting cabinets, power amplifier, loud speaker, two generators and switchboard, remote control box, 5 VT 1 and 3 VT 2 and phone transmitter. \$150 without batteries, \$225 with Edison Storage Batteries and Tungar charger. S. Miller, 303 Fourth Avenue, New York.

NEUTRODYNE COILS (neutroformers) correctly wound on best grade natural bakelite tubing, set of three \$4.50. 13 plate variable condensers to go with coils, best grade \$2.25 each. Neutralizing condensers (neutrodons) \$1.00 per pair. Money refunded if not satisfactory. Add postage. H. Butterworth, 331 Quincy St., Brooklyn, N. Y.

FOR SALE: New Grebe CR9 receivers \$90.00. New 10-A Western Electric power amplifiers complete with horn and tubes \$100.00. Dakota Radio Apparatus Co., Yankton, So. Dak.

WANTED: All A.R.R.L. members to know that we have a complete stock of radio parts and give mail orders special attention. Write, phone or wire. Hardsoig Mfg. Co., Radio Division, K.F.J.L., Ottumwa, Iowa.

FIFTY ASSORTED FLAT HEAD solid brass machine screws, nuts, washers, copper lugs, 50¢. Eight initial binding posts, set 60¢. Twelve nickelized binding posts 50¢. All three items \$1.50. RADIO LIST for stamp. All prepaid. Stamps accepted. Kladag Radio Laboratories, Kent, Ohio.

\$12. EACH takes Ohio or Wagner 110 volt sixty cycle eighteen hundred R.P.M. motors built in $\frac{1}{4}$ H.P. frames. Can be used as power motors. Type G Edison elements per pair $3\frac{1}{2}$. Highest quality $\frac{1}{2}$ " x 6" test tubes \$3.00 gross. Perforated hard rubber separators $1\frac{1}{4}$. No. 20 99% pure nickel wire \$1.50 per hundred feet. 25% off on 4 new Acme $\frac{1}{2}$ and $\frac{1}{4}$ K.W. Plate transformers. Kimley Electric Company, Inc., 2665 Main St., Buffalo, N. Y.

RADIO GENERATORS—500 Volt 100 Watt \$28.50 each. Battery Chargers \$12.50. High Speed Motors, Motor-Generator Sets, all sizes. Motor Specialties Co., Crafton, Penna.

HAMS WHO DESIRE SPEED—a moment's attention. Brother Ham whose limit was 15 words doubled his speed in One Evening. Send your Call and ask for the facts as told by himself. Dodge Radio Shorthut, Dept. SC, Mamaroneck, N. Y.

TELEGRAPHY—Morse and Wireless—taught at home in half usual time and at trifling cost. Omnidigraph

ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS

Automatic Transmitter will send, on Sounder or Buzzer, unlimited messages, any speed, just as expert operator would. Adopted by U.S. Govt. and used by leading Universities, Colleges, Technical and Telegraph Schools throughout U.S. Catalog free. Omnidigraph Mfg. Co., 16M Hudson St., New York.

SELL: New Grebe CR-5 \$55.00, RORN \$40.00, R-3 Magnavox old style \$22.50, DeForest D-4 \$22.00 (used), RCA chopper Signal motor \$12.00, C-303 (12 hours) \$20.00, Acme 150 watt filament transformer \$13.00, General Electric motor generator, 3450 R.P.M. 69 segment commutator, 500 volt, 100 watt \$49.00. What do you need? Terms: C.O.D., $\frac{1}{4}$ cash with orders. 8CDC, John Taylor Galey, Third and Taylor, Beaver, Pa.

SIG CARDS 500 POSTCARD SIZE PRINTED IN BLACK INK WITH LARGE RED CALL LETTERS \$4.00; 500 GOVERNMENT POSTALS \$8.50 NOT OVER TEN LINES. CASH WITH ORDER. BY A.R.R.L. MEMBER. CURTIS, 1109 EIGHTH AVENUE, FORT WORTH.

QST HAM ADVERTISERS

Radio men are notoriously poor penmen. Some of the HAM ADS we get in here are almost illegible. Please co-operate with us and the printers and insure your ads being printed absolutely correctly by sending in your HAM ADS typewritten and double spaced, if you can possibly do so. Be sure and give your complete address. Thanks—QST Advertising Department.

WANTED—about 3,000 members of the League to pay some attention to our attempts to get information on the location of dead spots. So far all hands have acted as if they never heard of a dead spot. Address the Technical Editor.

WANTED—Urgent need of comparative tests showing some method of filtering synchronous rectifiers so as to give good note locally. Address Technical Editor.

HAVE YOU SPENT HOURS trying to cut peep and meter holes in panels. I have a tool that drills them one to five ins. in diameter as easily as quarter in. ones. Only \$2.50 Post-paid. Homer H. Malcomb, Whitewater, Wis.

QRA SECTION

50c straight, with copy in following form only: CALL-NAME-ADDRESS. Any other form takes regular HAM-AD rates.

1AID—Miss Mildred S. Lorentson, 23 Braman St., Providence, R. I.

1ZD es 1CAK—John M. Wells, 40 Main Street, Southbridge, Mass.

2ADU—W. Constantineides, 137 Woodland Ave., Rutherford, New Jersey.

2AT—Robert H. Butler, 1324 River Road, Edgewater, N. J.

2CIL—M. Eugene Bussey, 16 Cedar Place, Yonkers, New York.

2CJ—N. Dmytryk, Jr., 507 Elm St., Cranford, N. J.

2JD—J. F. Rodenbach, 171 Norfolk Street, Manhattan Beach, Brooklyn, N. Y.

3KO—Paul R. Kern, 1030 N. 10th St., Reading, Pa.

4KW—W. Mulford Marsh, 1654 College St., Jacksonville, Florida.

4SN—Clifford O. Trichler, 26 Todd Road, Atlanta, Georgia.

5ABU—J. A. Harvey, 728 So. 6th St., Baton, New Mex.

5KQ—McIlvaine and Breedlove, 106 W. Third St., Sheffield, Alabama.

5KV—M. E. Eaton, Box 384, Henrietta, Texas.

5BS—F. G. Atwater, 406 W. Main St., Houston, Tex.

5MN—Tom Lytle and Horace Biddy, 545 Hicks Ave., San Antonio, Texas.

5TO—D. C. Mast, Nacogdoches, Texas.

6ADH—H. D. Wilson, Box 8, Phoenix, Arizona.

6ZBH—James F. Brady, 2012 Pacific Ave., Alameda, Calif.

6DO—Norman A. Woodford, 440 Tenth Street, Richmond, Calif.

6ZAT—Lyndon Farwell, Los Gatos, Calif.

ALASKAN 7MN—F. H. Stephens, Box 356, Ketchikan, Alaska.

8AFM—Eugene B. Etchells, Yale, Mich.

8ANM—H. J. Crisick, W. Washington St., Medina, Ohio.

8FJ (Ex 8AXC)—Edward Manley, 214 Fifth St., Marietta, Ohio.

8BNA, 103 N. Main St., London, Ohio.

8CMH—Connell H. Miller, Sligo, Pa.

8XB-PWA—1549 Temple, Detroit, Mich.

8ANX—R. B. Frank, 6440 Parnell Avenue, Chicago, Ill.

9BPT—Harry Clingenpeel, Flora, Indiana.

9CEL—C. Houghton Will, 1210 Boundary St., Red Oak, Iowa.

9CHV—Glen W. Earnhart, 508 Harvey Avenue, West Lafayette, Indiana.

G2SZ—C. W. Goyder, 44 Hale Lane, Mill Hill, London, England.

Can 3AFV—K. Drummond, 63 Inglewood Dr., Toronto.

Through an error the call letters of S. Forrest Martin, were given as 1BJD. These are the call letters of Willard S. Felch, 69 Bay View Ave., Winthrop, Mass. 1BJB is S. Forrest Martin, The Choate School, Wallingford, Conn.

Through an error in the February QRA section, the call letters of 8XBL were given as SBXL. His ad should read as follows:—8XBL, below 100 meters, 8ACF, 1025 Baldwin, Ann Arbor, Mich.

Genuine Western Electric VT-2 Tubes

\$7.45

Send 10¢ for copy of new 48 page

RADIO CATALOG
CHICAGO SALVAGE STOCK STORE
509 S. State St., Dept. Q-6 Chicago, Ill.

2650 MILES

ON ONE TUBE, Broadcasting from Atlantic Coast, Mexico, Canada, Cuba and Hawaii, heard in California, by users of the CROSS COUNTRY CIRCUIT. Atlantic Coast users hear California. Range due to simplicity of set and operation by one tuning control. Easy and cheap to build by any novice. Dry cell tubes may be used. Complete understandable instructions, full size panel layout, assembly photo, etc. Postpaid, 25 cents; stamps accepted.

Box Q-117 VESCO RADIO SHOP Oakland, Calif.

"TELL 'EM WHO YOU ARE" LICENSED OPERATORS

YOUR
CALLS
IN
SOLID
GOLD



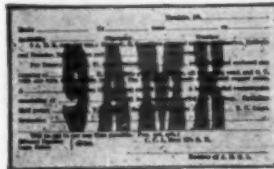
50 Watt
tube pins
Back-
ground
of 20 yr.
gold
plate
\$2.00
M.O. or
check

(Twice actual size)

Money refunded if pins are not "FB"

R. C. BALLARD, 9FZ
1202b W. Oregon St., Urbana, Ill.

Use Individual CALL CARDS



We Print Them
TO ORDER

A. R. R. L. Emblem
added if requested by
member.

MONEY REFUNDED
if not thoroughly
satisfied.

Red call, black print-
ing, 100—\$1.75; 200—
\$2.75, postpaid. Blue,
green or brown call,

85¢ extra. Government postcards, 1¢ extra per card.
PERSONAL LETTERHEADS & ENVELOPES

Showing your station, name and address. Good quality,
clear white smooth surface bond paper. Letterheads 8½
x 5½, Envelopes 6 inches long, 100 each—\$2.25; 200 each
—\$3.25; 300 each—\$4.25; 500 each—\$6.25 PREPAID.

Broadcasted Market Reports: 100—\$1.00; 200—\$1.75.

Send order with check or money order today—NOW.

RADIO PRINTERS, Dept. 13, Mendota, Ill.

THE SCIENTIFIC HEADSET

The greatest value on the market. Only
\$2.95 postpaid, or order C.O.D.

THE SCIENTIFIC ELECTRIC WORKS
98 Brookline Ave., Dept. G, Boston, Mass.

RADIO PANELS

Cut exactly to size and a guaranteed 12 hour
shipment. $\frac{1}{4}$ " thick .01 $\frac{1}{2}$ ¢ per square inch. $\frac{1}{8}$ "
thick .01 $\frac{1}{2}$ ¢. Made of the highest grade black
fibre. This material possesses electrical strength
of 200 volts per mil, is inexpensive, unbreakable,
easy to work and takes a fine finish. We pay
postage.

RADIO INSTRUMENT & PANEL CO., 584 W. Monroe St., Chicago, Ill.

SUPER-HETERODYNE

Aircore Radio Frequency Transformers
3000 Meters.
Set of four transformers and complete
blueprints.

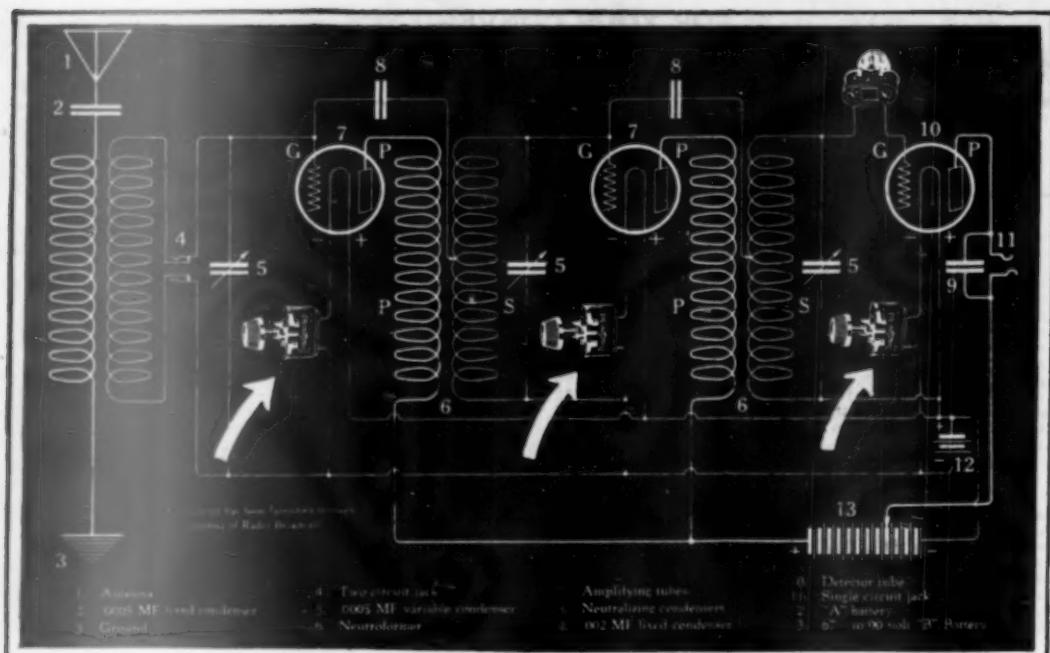
Price \$25.00
RADIOPHONE EQUIPMENT CO.
1409 W. York St. Phila.

—FOR YOUR CONVENIENCE—

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ALWAYS MENTION QST WHEN WRITING TO ADVERTISERS



Use the Bradleystat in the Neutrodyne



Mail This Coupon—TODAY!

Allen-Bradley Co.,
277 Greenfield Ave., Milwaukee.

Please send me information about the Universal Bradleystat, the perfect filament control. I want better radio reception.

Name _____
Address _____

THE discriminating radio fan is forever improving his set. At first, the actual accomplishment of radio reception is all that is asked, but in a short time new hookups are tried or new equipment is used to improve reception.

A good hookup is worthless without good equipment and, of all things, perfect filament control is most important. The high efficiency of a good tuner is quickly lost with poor filament control.

The Universal Bradleystat makes any radio set better. Its noiseless, stepless control never fails to surprise and delight the radio fan trying to make long distance records. The recent Radio Broadcast long distance contest gave the Bradleystat first place for superior performance. Replace your present rheostat with Bradleystats and enjoy better radio.

WHEN YOU BUY A RADIO SET, ASK FOR BRADLEYSTATS

In U. S. A.

\$1.85

at all dealers

Allen-Bradley Co.
Electric Controlling Apparatus

In Canada

\$2.50

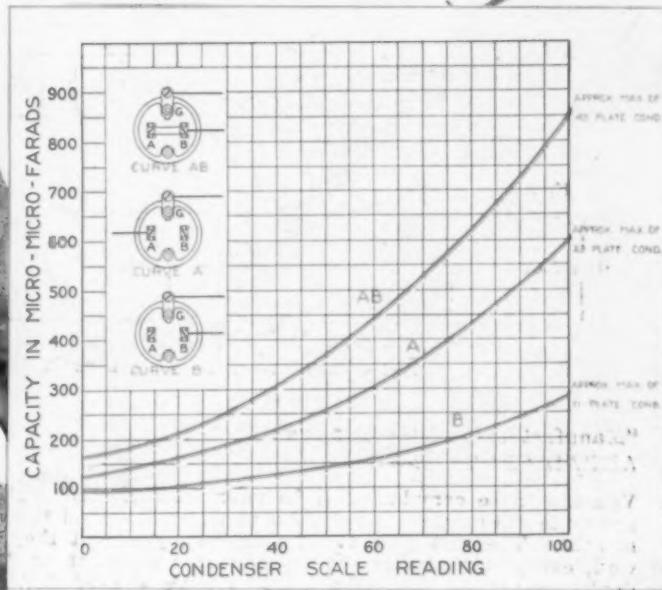
at all dealers



277
Greenfield
Ave.
Milwaukee,
Wisconsin

MANUFACTURERS OF GRAPHITE DISC RHEOSTATS FOR OVER 20 YEARS

Triple Range



Three Condensers in One

Here it is—just what you've been looking for—

The Connecticut D-10 Triple Range Variable Condenser—

A single unit that takes the place of the eleven, the twenty-three and forty-three plate condensers of the ordinary type—

A neat compact instrument that covers the full field of usefulness—With all the advantages that go with full scale rotation, perfect shielding, complete housing and one hole mounting.

The chart tells the story—

The range indicated by Curve B—from .000075 to .00275 mfd.—approximately that of an eleven plate condenser, is secured by wiring into the circuit from posts G and B. The range indicated by Curve A—from .0001 to .0006 mfd.—approximately that of a twenty-three plate condenser, is secured by wiring into the circuit from posts G and A.

The range indicated by Curve AB—from .00015 to .00085—approximately that of a forty-three plate condenser is secured by bussing A and B and wiring into the circuit from G and B.

A most practical adaptation of a research laboratory instrument. Just the thing for the amateur, the experimenter, and the man who likes to develop his own hook-ups.

COMPACTNESS

Diameter of case 2 9/32" Depth of case 1 3/8"

EASE OF MOUNTING

Condenser is mounted on threaded bushing and clamped to panel between two units. Adapted for installation on 1/8", 3/16", or 1/4" panels.

COMPLETE SHIELDING

Since terminal G is common with the case, as well as with two sections of the condenser, a connection from G to A ground or a negative battery terminal automatically shields the condenser against body capacity and capacity coupling.

VERNIER SCALE

Design which provides 345° of dial rotation as against the usual 180° gives a vernier ratio of about 2 to 1, and permits correspondingly chosen settings.

AUXILIARY EQUIPMENT

A dial, index stud, spacing washers for less than 1/4" panels and bus bar for connecting A and B in parallel as shown in diagram AB, furnished with condenser.



Type D-10
Variable Condenser
\$4.50 Complete

Price \$4.50 Complete

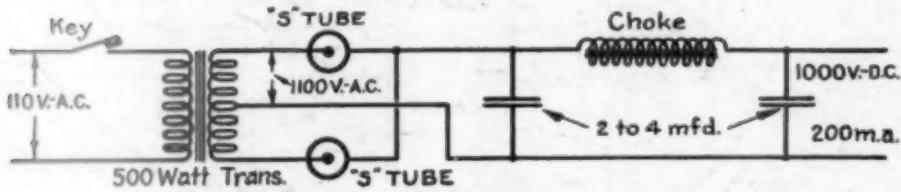
Bulletin A-104 upon request.

CONNECTICUT TELEPHONE & ELECTRIC COMPANY **CONNECTICUT**

MERIDEN RADIO DIVISION

AMRAD

"S" -- TUBE



Typical Circuit for Using AMRAD "S" Tube Rectifiers.

"Manufacturers of the Famous
AMRAD "S" Tube:-

Jan. 16, 1924

You are to be complimented on your AMRAD "S" Tubes. I'll tell the world they are quite the berries. I bought a pair and have had them in use for just about three months. The first time I put them in my circuit they worked F.B. As for tone, well, every station that I work gives me a report as "PURE DC". As for DX, I don't see how they can be beat. I have worked 1700 miles on 5 watts. I have been heard in all districts, Mexico, Canada and forty States. I have worked 9BZI, Ackley, Ia., and 9DDJ, Lankford, S. D., on 5 watts, loop modulation. In daylight I have worked 1,000 miles often."

P. B. Ward, Jr., (5AFH)
610 N. Main St.,
Cleburne, Texas.

SPECIFICATIONS

(Improved Type #4000)

No Filament to Burn Out.

Operates CW transmitters utilizing either 5 or 50 watt power tubes.

May be used to charge storage "B" Batteries.

Fits standard base.

A 100% Rectifier

Ratings per Tube—

Current: 100 milamps

Voltage: Up to 1000 volts DC

Life: 3000 hours (very conservative).



Improved AMRAD "S" TUBE #4000, Price \$10.00 each.

SEND FOR FREE

BULLETIN J-2

Users of "S" Tubes are our best advertisers. Read editorial articles in QST and Popular Radio for February, to see widespread interest "S" Tubes are provoking. From time to time we publish in this space letters from owners of "S" Tubes. It is significant that most of these published so far refer to the old type #3000, which is greatly improved in #4000, here illustrated.

Order from your Dealer or remit to

AMERICAN RADIO AND RESEARCH CORPORATION

205 College Ave., Medford Hillside, Mass.

AMRAD Dealers in Principal Cities and Towns